

Decision **PROPOSED DECISION OF ALJ TERKEURST** (Mailed 6/20/2006)

**BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA**

Order Instituting Investigation on the  
Commission's Own Motion into Methodology for  
Economic Assessment of Transmission Projects.

Investigation 05-06-041  
(Filed June 30, 2005)

**(See Attachment B for List of Appearances.)**

**OPINION ON METHODOLOGY FOR  
ECONOMIC ASSESSMENT OF TRANSMISSION PROJECTS**

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## **OPINION ON METHODOLOGY FOR ECONOMIC ASSESSMENT OF TRANSMISSION PROJECTS**

### **I. Summary**

The Commission opened Investigation (I.) 05-06-041 in order to consider methodologies for the economic assessment of proposed transmission projects. In today's decision, we adopt general principles and minimum requirements and provide other guidance for economic evaluations of proposed transmission projects that may be submitted in Commission certificate of public convenience and necessity (CPCN) proceedings.

A threshold issue is what deference should be given to determinations by the California Independent System Operator (CAISO) regarding the cost-effectiveness and need for a transmission project that is proposed for its economic benefits. The CAISO is a critical player in California's efforts to ensure reliability and economic efficiency of the transmission system. The CAISO's work in developing its Transmission Economic Assessment Methodology (TEAM) has advanced the state of the art in economic evaluations of transmission projects. We agree with and adopt many aspects of the CAISO's TEAM approach. As discussed in Section IV of this order, we believe that it would be counter to the public interest to shift the burden of proof from an applicant requesting a CPCN for a transmission project. Therefore, we decline to adopt the CAISO's proposal that a rebuttable presumption of economic efficiency be triggered in a CPCN proceeding in which the applicant relies on the study underlying a CAISO determination that the transmission project is cost effective.

We agree with the consensus among the parties that Commission requirements regarding economic evaluations of transmission projects should not be overly prescriptive. Instead, today we adopt general principles and provide guidance to establish a framework for economic evaluations to be submitted in CPCN proceedings. The adopted principles, along with minimum requirements for economic evaluations, are appended as Attachment A to this order, and can be summarized as follows:

1. The CAISO's standardized benefit-cost methodology shall be used to measure the economic benefits of proposed transmission projects. The perspective of CAISO ratepayers is of primary importance in a CPCN proceeding, although there is value in reviewing benefit-cost results from other perspectives as well.
2. The CAISO's framework for the computation of potential energy benefits shall be used. Parties shall assess energy benefits using established, credible, and commercially available production cost modeling tools. The applicant may decide whether to include market power mitigation benefits as part of its demonstration of need for a proposed transmission project.
3. In addition to energy benefits, other economic effects of a transmission project may be considered, including economic effects that may not be quantifiable.
4. Economic evaluations shall consider how uncertainty about future system and market conditions affects the likelihood that a transmission project's forecasted benefits will be realized.
5. Economic evaluations shall use baseline resource plans and assumptions about the system outside the applicant's service territory that are consistent with resource plans and system assumptions used in procurement or other recent Commission proceedings, updated as appropriate.

6. Economic evaluations shall consider feasible resource alternatives to the proposed transmission project.

The Commission is taking steps to simplify transmission planning and permitting procedures and make them more efficient, both here and in I.05-09-005 and other venues. Our adoption today of principles and guidance regarding economic evaluations of proposed transmission projects will complement the Commission's streamlining efforts and further the goal of greater coordination and consistency between the Commission and the CAISO. The adopted principles and guidance should be useful to parties that participate in the CAISO review. Parties that provide economic evaluations to the CAISO that are consistent with our guidelines may also submit them in our CPCN proceedings, thus reducing duplication of efforts, the expense of participating both at the CAISO and here, and the time required for the two reviews. Additionally, if CAISO review precedes Commission review of a proposed project, parties' experience in defending their project evaluations during the CAISO process should narrow issues and streamline the process in the CPCN proceeding here.

## **II. Background**

This investigation has been coordinated with Phase 1 of Application (A.) 05-04-015, the application of Southern California Edison Company (SCE) for a CPCN to construct the Devers-Palo Verde No. 2 (DPV2) transmission project, a proposed 230-mile, 500 kilovolt alternating current transmission line between California and Arizona. DPV2 would connect SCE's existing Devers substation near Palm Springs, California to the existing Harquahala Generating Company switchyard located approximately 49 miles west of Phoenix, Arizona.

On June 30, 2005, the Commission opened I.05-06-041 to consider appropriate principles and methodologies for assessment of the economic benefits of transmission projects, including DPV2, that are submitted for Commission approval. The Commission named SCE, Pacific Gas and Electric Company (PG&E), and San Diego Gas & Electric Company (SDG&E) as Respondents to the investigation. As established in the Order Instituting Investigation (OII), the Commission wished to consider, in particular, the CAISO TEAM approach to economic evaluation of transmission projects, both as an evaluative framework and as applied to assess the economic benefits of the DPV2 project. The OII provided that issues then under consideration in I.00-11-001 regarding the methodology for assessment of the economic benefits of transmission projects were subsumed in I.05-06-041, and that the record on these issues developed in I.00-11-001 would be fully available for consideration in I.05-04-061.

A prehearing conference was held in A.05-04-015 and I.05-06-041 on July 20, 2005. The Assigned Commissioner issued the scoping memo for the two proceedings on August 26, 2005. The scoping memo categorized I.05-06-041 as ratesetting and stated that hearings were necessary. The scoping memo also provided that evidence regarding DPV2 would be received in two phases. Phase 1 would address need issues and the economic methodology used to assess cost effectiveness on a coordinated basis for A.05-04-015 and I.05-06-041. Phase 2, in A.05-04-015 only, is underway to address environmental, routing, updated cost estimates, and other issues related specifically to DPV2. The Commission plans to rule on SCE's CPCN request for authorization to construct DPV2 by the end of 2006. In that decision, we will consider Phase 1 evidence

regarding the cost-effectiveness of DPV2 in addition to other CPCN issues considered in Phase 2.

Among other issues in I.05-06-041, the Commission planned to address validation of and reliance on CAISO assessments of need in Commission proceedings. Parties discussed this issue, among others, at a joint workshop held on September 14 - 15, 2005. Based on workshop discussions, a September 27, 2005 Administrative Law Judge (ALJ) ruling determined that a complete validation of the CAISO's TEAM approach should not be pursued at this time. The ALJ ruling established that Phase 1 would address the following issues related to I.05-06-041, in addition to issues related to the need for the DPV2 transmission project under consideration in A.05-04-015:

1. What general principles or methodologies should the Commission employ in assessing the economic benefits of transmission projects within its jurisdiction?
2. Is the CAISO's TEAM approach, as applied to Path 26 and to DPV2, consistent with such general principles or methodologies?
3. Are the following procedures a reasonable approach at this time for the Commission's assessment of the economic benefits of transmission projects?
  - a. In I.05-06-041, the Commission would adopt principles, a framework for decision-making, and criteria for the economic analysis of transmission lines.
  - b. In subsequent certificate proceedings, the Commission would evaluate whether the CAISO, in evaluating economic need for the proposed project, has followed the guidance provided by the Commission in a reasonable manner.
  - c. If so, the Commission would adopt the CAISO's economic determination, so that the outcomes at the CAISO and the Commission would be consistent.



4. After the Commission adopts general principles or methodologies for assessing the economic benefits of transmission projects, how should the Commission evaluate in a certification proceeding whether the CAISO, in evaluating economic need for the proposed project, has followed the guidance provided by the Commission in a reasonable manner?
5. If the Commission determines in a certification proceeding for a transmission project proposed for its economic benefits that a CAISO assessment of need has followed the guidance provided by the Commission in a reasonable manner, are there additional requirements that must be met in the Commission's determination of economic benefits and need for the project?
6. For those certification proceedings for transmission projects proposed for economic benefits where there is no CAISO assessment of need that the Commission has found to be reasonable and consistent with guidance provided in this investigation, what requirements should the Commission adopt for consideration of economic benefits and need?

We agree with the September 27, 2005 ALJ ruling that consideration of these issues in I.05-06-041, in the context of assessment of need for DPV2, should further the Commission's goal of streamlining transmission planning and help ensure consistency in Commission and CAISO results.

As provided in the September 27, 2005 ALJ ruling, parties filed comments and reply comments on Phase 1 issues. An ALJ ruling dated October 28, 2005 provided further guidance regarding the scope of Phase 1 testimony and evidentiary hearings.

Three days of evidentiary hearings were held in Phase 1 on January 10-12, 2006. The following parties filed opening briefs: the CAISO, SCE, PG&E,

SDG&E, Division of Ratepayer Advocates (DRA), The Utility Reform Network (TURN), Bay Area Municipal Transmission Group (BAMx),<sup>1</sup> and Global Energy Decisions, Inc. (Global Energy). All of these parties except BAMx also filed reply briefs. Following the receipt of late-filed exhibits and opening and reply briefs, Phase 1 was submitted on March 24, 2006. No party requested final oral argument before the Commission on Phase 1 issues in its opening brief, as allowed by the scoping memo.

### **III. Overview of Positions of the Parties**

To assist our consideration of the proper principles and methodologies for evaluating the economic benefits of proposed transmission projects, we have the benefit of the Phase 1 record containing four project-specific economic evaluations: the CAISO's evaluation using the TEAM approach of a possible Path 26 upgrade, submitted originally in I.00-11-001, and three separate economic evaluations of the DPV2 project submitted by the CAISO, SCE, and DRA. All parties submitted testimony and took positions regarding the submitted economic evaluations and related issues.

In today's order, we describe in some detail the principles and methodologies used in each of the four economic evaluations because they assist in our determinations regarding how best to analyze the economic benefits of a transmission project. We provide an overview of the positions of the parties regarding the principles and methodologies for economic evaluations of

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<sup>1</sup> BAMx is an unincorporated association of publicly owned utilities located in the Greater Bay Area. Members include the City of Santa Clara, Alameda Power and Telecom, and City of Palo Alto Utilities.

transmission projects and the manner in which the Commission should consider such evaluations in CPCN proceedings. We then address individual issues.

#### **A. CAISO**

The CAISO has been developing its TEAM approach for several years. At the direction of the ALJ in I.00-11-001, the CAISO submitted a report in June 2004 describing the CAISO's TEAM approach and its application to a potential project to upgrade the transmission path between central and southern California, which is commonly called Path 26 (June 2004 Report, which is Attachment 1 to Exhibit 11 in the Phase 1 record). In the June 2004 Report, the CAISO explained that the Path 26 study provided an opportunity to evaluate its TEAM approach in a realistic situation and to gain experience regarding areas for further enhancements. The CAISO concluded that additional refinements to TEAM would be needed to reach a definite conclusion regarding whether a Path 26 upgrade would be economically viable.

In analyzing the DPV2 project proposed by SCE, the CAISO made certain refinements to its TEAM approach. The CAISO has approved the DPV2 project as economically needed.

The CAISO considers five aspects of its methodology, which it calls key principles, to be necessary to any economic evaluation of a transmission project. While described in more detail in Section V, in summary, the CAISO's key principles include the following:

1. Benefit framework: utilization of a standardized benefit-cost methodology to measure transmission expansion benefits regionally and separately for consumers, producers, and transmission owners.
2. Network representation: measurement of energy benefits using a network model that reflects physical constraints of the transmission grid and forecasts nodal prices.

3. Market prices: measurement of energy benefits using a methodology that forecasts market prices by simulating producer bid strategies, to assess consumer benefits from reduced supplier market power.
4. Uncertainty: assessment of the impact of uncertainty about future market conditions through analysis of a representative set of market scenarios, with assignment of weighting factors (relative probabilities) to the different scenarios so that the expected benefit and range of benefits can be determined.
5. Resource alternatives: identification and consideration of alternative generation, demand-side management, and transmission investment decisions.

In addition to these mandatory key principles, the CAISO described several other TEAM attributes that it considers to be either requirements or recommendations for economic evaluations of transmission projects.

The CAISO urges the Commission to adopt TEAM's key principles as the minimum requirements in any economic evaluation of a proposed transmission project. The CAISO recommends that, in a CPCN proceeding considering a transmission project that the CAISO has already found to be cost effective, a project proponent may rely on the study underlying the CAISO's determination to trigger a rebuttable presumption of economic efficiency. In the CAISO's proposal, this rebuttable presumption would shift the burden of proof to an opposing party to demonstrate either that the project is not economic or that other factors in Public Utilities Code Sections (§§) 1001 and 1002<sup>2</sup> compel denial. The CAISO submits that adoption of a rebuttable presumption standard in which the burden of proof is shifted is warranted because of the public policy

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<sup>2</sup> All references to statutory Sections refer to the Public Utilities Code.

benefits of streamlining infrastructure development and creating greater coordination between Commission and CAISO processes.

The CAISO cites its statutory responsibilities under §§ 334 and 335 and argues that the ability to identify economic transmission projects is an integral part of its responsibility under § 345 to ensure the efficient use of the transmission grid.

Much of the CAISO's description of the TEAM approach is contained in the June 2004 Report, which applies the methodology to the potential Path 26 upgrade. In assessing TEAM, we rely on the detailed description of TEAM in the June 2004 report and on the CAISO's evaluation of DPV2, since that is the state-of-the-art application of the TEAM approach.

To evaluate potential energy benefits of DPV2 (and also Path 26), the CAISO used the PLEXOS DC Optimal Power Flow (DC-OPF) network model. We address system modeling issues in Section V.B.1 of this order. To forecast the amount by which market prices may be bid above system marginal costs, the CAISO used statistical relationships it found historically between price markups above cost and two measurements of system supply and demand conditions, as described in more detail in Section V.B.2.

As described in Section V.B.5, the CAISO analyzed the effects of uncertainty on the energy benefits of DPV2 by undertaking 17 system simulations using combinations of variations in load growth, hydro conditions, gas prices, and the degree of market power exhibited in producers' bids. The CAISO also analyzed several contingency scenarios representing extreme events for which it did not assign probabilities and whose results it did not include in the calculated benefit-cost ratios.

The CAISO modeled the energy system throughout the Western Electricity Coordinating Council (WECC) region with and without DPV2 in two years: 2008 and 2013. In calculating benefit-cost ratios for DPV2, the CAISO assumed that the energy benefits it found for 2013 would continue with a 1% real (adjusted for inflation) annual escalation rate through 2057.

In addition to energy benefits, the CAISO quantified and included in the benefit-cost ratios certain non-energy benefits of the DPV2 upgrade.

## **B. SCE**

SCE agrees with the concept of adopting general principles to guide the economic evaluation of transmission projects in CPCN proceedings. SCE emphasizes its view, however, that whatever guidance the Commission provides should not include any requirement that parties use a specific type of computer model or database, or that they forecast the effect of the proposed transmission project on producers' ability to wield market power.

SCE states that, under § 1003, the applicant has the burden of demonstrating in a certificate proceeding that the proposed project is, or will be, required for the public convenience and necessity. SCE is concerned that, in considering the CAISO's proposal to create a rebuttable presumption, the parties confuse the burden of proof with the burden of producing evidence. SCE states that the applicant in a CPCN proceeding always has the burden of proving that its proposed project is reasonable, and also the burden of producing evidence that supports its request.

SCE is concerned that emphasizing the CAISO's economic evaluation of the need for a project in a certificate proceeding may confuse the CAISO's role with that of the utility applicant. SCE emphasizes its view that the utility applicant must have the ability to choose how best to meet its burden of proof

and that the applicant can choose whether to rely on the CAISO's evaluation. SCE suggests that the Commission adopt a modification of the fourth principle that DRA recommends (see Section III.C below) as follows:

The applicant is responsible for its showing and justification before the Commission. If the CAISO has determined that a project is needed, the applicant should present that fact and may use the CAISO assessment to help it meet its burden of proof. The CAISO is encouraged, but not required, to participate in Commission licensing proceedings.

SCE forecasted DPV2's impact on energy costs using the Global Energy (formerly Henwood) transportation model. SCE studied the period from June 1, 2009 – the proposed energization date for DPV2 – through December 31, 2015. SCE assumed that estimated 2015 energy benefits would continue at the same level in real terms through 2055, i.e., escalated each year only by inflation. To assess DPV2's benefits over a wide range of load forecasts, natural gas prices, and available hydroelectric generation, SCE utilized stochastic tools (described in more detail in Section V.B.4) to perform 100 simulations, with load forecasts, gas prices, and hydro levels chosen stochastically.

In addition to energy benefits, SCE quantified and included in its benefit-cost analysis the amount by which it expects third-party transmission revenues to increase with the addition of DPV2, due to the increased revenue requirement used to develop rates for CAISO wheeling service and Existing Transmission Contracts.

### **C. DRA**

DRA recommends that the Commission focus on general principles used to evaluate the economic need for a transmission project, and allow

applicants to determine how to apply the adopted principles, subject to Commission scrutiny on a case-by-case basis.

DRA recommends adoption of four principles, which can be summarized as follows:

1. Assessment of energy benefits. Energy benefits should be assessed using an established, credible, and commercially-available production cost modeling tool. Computer model access requirements of §§ 1821 and 1822 should be met consistent with Rule 74,<sup>3</sup> or reasonable alternative computer model access rules may be established on a case-by-case basis.
2. Input assumptions and uncertainty analysis. The applicant should rely on input assumptions developed for the State's most recent major resource planning proceeding. In addition to a base case, uncertainty analyses are appropriate based on alternative assumptions about key variables.
3. Analysis of alternative resource options. The applicant should prepare economic assessments of a variety of resource alternatives to the proposed transmission project, including, but not limited to, other transmission projects, generation projects, demand-side options, and distributed generation.
4. Responsibility of the applicant. The applicant is responsible for its showing and justification before the Commission. The applicant is encouraged, but not required, to coordinate its assessment of the transmission project with the CAISO's assessment of the project.

DRA states that the CAISO's TEAM approach is generally consistent with the four principles DRA recommends, but that the CAISO over-prescribes methodologies to implement the principles, in particular, its requirement that a full network model be used.

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<sup>3</sup> Cites to Rules refer to the Commission's Rules of Practice and Procedure.



DRA opposes the CAISO's recommendation that economic analyses performed by or otherwise found acceptable by the CAISO for its own purposes be granted a rebuttable presumption of reasonableness in Commission CPCN proceedings. DRA argues that the CAISO's rebuttable presumption proposal is inconsistent with the Commission's statutory mandates under §§ 1001 and 1003 and the historical use of rebuttable presumptions. DRA maintains that the CAISO's analysis and findings should be treated like any other facts presented to the Commission and should be accorded the appropriate weight due any evidence that has been tested through the hearing process.

Like SCE, DRA used the Global Energy transportation model for its economic assessments of DPV2. DRA based its modeling of DPV2's potential energy benefits on SCE's analysis, with modifications as DRA deemed appropriate. While SCE performed stochastic analyses, DRA developed a deterministic reference case and several additional market simulations to evaluate DPV2.

To assess the impact of "forecast risk," DRA developed an Uncertainty Margin method to quantify the level of forecast risk that can be accepted. DRA also proposes what it calls a tipping point analysis, in which parties identify which parameters, assumptions, or relationships drive the conclusions of their economic evaluations.

#### **D. PG&E**

PG&E cautions that the Commission should minimize the need for continuing reassessment of principles and criteria endorsed in this proceeding by focusing on general principles rather than particular models or assumptions.

PG&E's view is that, if the CAISO employs general principles articulated by the Commission, the Commission should defer in a CPCN

proceeding to the CAISO's finding of need. PG&E argues that pursuant to §§ 334 and 345 and the CAISO's tariff approved by the Federal Energy Regulatory Commission, the CAISO is responsible for determining which transmission projects are needed within its control area. PG&E asserts that, consistent with the CAISO's tariff, the CAISO has the authority to compel construction of transmission upgrades it determines to be needed, subject to right of appeal. PG&E recommends that the Commission adopt the three-step procedural framework identified in Issue 3 in the September 27, 2005 ALJ ruling, on the basis that these procedures would reduce the threat of inconsistent results and would expedite the siting process for transmission projects.

PG&E recommends that Commission consideration of project need issues be limited to verifying that the CAISO applied Commission-recommended principles, and that the Commission not review the merits of the CAISO's analysis unless the CAISO failed to apply one or more of the Commission-recommended principles. PG&E would also support the solution developed by the CAISO of creating a rebuttable presumption, if needed to address legal concerns raised by granting full deference to a CAISO need determination. PG&E submits that such an approach provides more than adequate safeguards for intervenors in CPCN cases, is consistent with the CAISO's authority over transmission planning, and is well within the Commission's authority to adopt.

Regarding specific guidelines, PG&E generally supports the principles recommended by the CAISO, but takes issue with the CAISO's proposal that use of a network model be required.

#### **E. SDG&E**

SDG&E states that the Commission should defer to CAISO need determinations, giving them a rebuttable presumption of validity. In SDG&E's

view, if the CAISO follows principles and an analytical framework adopted by the Commission in a reasonable manner, the Commission should adopt the CAISO's need determinations.

SDG&E disagrees with some of the more prescriptive recommendations of the CAISO, in particular its network model requirement and its suggestion that the Seams Steering Group – Western Interconnection (SSG-WI) database be used. SDG&E acknowledges possible complications regarding access limitations to models and databases the CAISO may use, but submits that the Commission must accept these access limitations in order to grant deference to the CAISO need determinations. SDG&E acknowledges that Commission deference to the CAISO may not be appropriate if the Commission wishes to consider a broader range of generation and demand-side alternatives than the CAISO evaluates. SDG&E also cites transmission needed to attain renewable resource goals as a situation where the Commission may approve a transmission project even if the CAISO found it was not needed.

## **F. TURN**

TURN supports Commission endorsement of the CAISO's proposed benefits framework, but recommends that the Commission not endorse the other elements of TEAM at this time. TURN submits that methods for economic evaluation of transmission projects are still evolving and, it contends, there is no need to halt that evolution by locking into one specific approach.

TURN believes that the three-step procedures identified in Issue 3 in the September 27, 2005 ALJ ruling “move much too far and too fast.” TURN believes that the first step, in which the Commission would adopt principles, a framework for decision-making, and criteria for the economic evaluation of transmission lines, is as far as the Commission should go at this time. TURN

recommends that the Commission evaluate in CPCN proceedings whether each party has followed any adopted guidelines or has made a reasonable case for modifying those guidelines. TURN opposes any special deference to the CAISO's determination of economic need, citing both legal and practical reasons, including that the CAISO is a private corporation rather than a governmental agency, and that the CAISO does not conduct a public process in which its assumptions and model inputs can be tested and ratepayer concerns fully aired.

TURN argues that the Commission should continue to hear from all parties in CPCN proceedings and should continue to make its decisions based on the overall weight of the evidence. TURN emphasizes its views that the applicant has the burden of proving that its proposed project has economic benefits for ratepayers and that shifting this burden would be inappropriate.

TURN maintains that the TEAM approach, while a valuable work product, is not specific enough to allow the Commission to defer to any one party's proposed implementation of the methodology. TURN maintains that two different parties could undertake analyses consistent with the overall TEAM framework but still reach different conclusions regarding the economics of a particular project, and that those differences would still need to be examined in a regulatory process.

Regarding the perceived need to shorten the approval process for proposed transmission projects, TURN points out that there is no requirement that a utility present a proposed transmission project to the CAISO first and gain its approval prior to filing a CPCN application. TURN suggests instead that the CAISO and Commission could conduct their analyses in parallel as a way to speed approval of worthy transmission projects.

### **G. Global Energy**

Global Energy does not support the three-step procedures identified in Issue 3 in the September 27, 2005 ALJ ruling. It argues that deference to the CAISO could deprive the Commission of hearing the recommendations and analyses of the applicant and other parties and, since the CAISO does not hold hearings, could deprive parties of a reasonable opportunity to participate in the project evaluation. Global Energy comments that, in order for a more deferential approach to be reasonable, the Commission would have to be highly prescriptive in identifying the principles to be used and the framework and criteria for decision-making. Global Energy asserts that such a prescriptive approach is not practicable now and could quickly become outdated. Global Energy suggests instead that the Commission adopt general guidelines, principles, and methodologies for use by all parties.

Global Energy argues that the type of network model used by the CAISO does not provide what it calls a “true” DC-OPF analysis and is less acceptable than a transportation model such as the one used by SCE and DRA. Global Energy suggests that the Commission provide guidance that, for proposed transmission projects above a specific dollar threshold (e.g., if the project is expected to cost \$500 million or more), parties must perform a more accurate AC-OPF analysis. For smaller projects, Global Energy recommends that the Commission allow a DC-OPF analysis using variable shift factors and with the modeling of non-linear elements such as DC lines, and also allow transportation models if computational experiments show that little bias results from using such models.

## **H. BAMx**

BAMx supports the CAISO's TEAM approach as a useful analytical framework for the economic evaluation of transmission projects. BAMx suggests that the Commission adopt certain elements of the TEAM principles as "safe harbor" principles, with studies in compliance with the adopted principles accorded greater weight in a determination of project need. In particular, BAMx recommends that the Commission give preference to use of a network model and the SSG-WI database. BAMx suggests that the costs of new entry, that is, capacity values, need to be developed to assess project benefits.

## **IV. Consideration of Economic Benefits in Transmission Project CPCN Proceedings**

### **A. The Need for General Principles and Guidance**

In Decision (D.) 01-10-070 issued in I.00-11-001, the Commission recognized that, in a restructured electricity market, traditional methods are inadequate for assessing the economic benefits of transmission projects. At the Commission's request, the CAISO began to develop a generic methodology and analytical tools for economic evaluations of transmission projects in dynamic market conditions. In developing its TEAM approach, the CAISO has made substantial contributions to advancing the art of transmission economic analysis.

Nevertheless, as discussed below in Section V, substantial concerns remain regarding the ability to model aspects of the increasingly complex inter-regional transmission and generation system that serves far-flung geographic areas with different market structures. We are confident that continued developments in system modeling capabilities will allow more accurate estimates of production costs, and that computer advances will reduce processing times and thus allow more refined uncertainty analyses. Any

detailed requirements and criteria that we could adopt at this time would need to be revisited and updated as the state of the art in economic assessment progresses.

Transmission projects may be proposed in various configurations and sizes and for various economic purposes, such as inter-regional bulk power transfers, congestion relief, or to meet other intra-regional needs. The wide range of transmission projects that may be proposed for economic reasons would further complicate any efforts to adopt detailed study requirements applicable to them all.

As long as the adopted principles and minimum requirements for economic evaluations are met, there may be value in having economic analyses in CPCN proceedings undertaken using multiple approaches. As an example, both network models and transportation models have strengths and weaknesses, as we discuss in Section V.B.1. Analyses using both approaches may be complementary in some respects and thus provide stronger underpinnings for our need determinations.

For these reasons, we focus on general principles rather than overly prescriptive directives to reduce the need for continuing reassessment of the guidance we adopt today. The minimum requirements will help ensure that economic evaluations are undertaken consistent with the general principles and guidance provided in today's decision. A common goal of many of the minimum requirements is that each party should explain and justify its study design and should report results in a manner that facilitates understanding of its economic evaluation and comparison with evaluations that may be submitted by other parties.

## **B. The Role of CAISO Economic Evaluations in Commission CPCN Proceedings**

The CAISO, PG&E, and SDG&E assert that the CAISO has primary jurisdiction over need determinations. The Commission has considered similar arguments previously, and has repeatedly affirmed our jurisdiction and statutory responsibility to assess need in a certificate proceeding. (See D.03-05-038; see also D.02-10-065, D.02-10-066, D.01-05-059, and D.01-10-029. See also D.99-09-028 regarding the general issue of transmission jurisdiction.) We see no need to revisit this issue at this time. As we summarized previously:

[D]eference that consists of adopting the [CA]ISO's need assessment without conducting an independent review cannot substitute for our mandate to consider need for the project under Section 1001. (D.03-05-038, *mimeo.* at 12.)

The CAISO's proposal that its economic evaluations be granted a rebuttable presumption of reasonableness arguably does not reach the level of deference rejected in D.03-05-038. Under the procedures recommended by the CAISO, parties would have the opportunity to challenge the CAISO's findings in the Commission's CPCN proceeding and to introduce evidence to attempt to persuade the Commission that it should not adopt a CAISO need determination.

The Commission has long held that the applicant carries the burden of proof in a certification proceeding. We believe that it would be counter to the public interest to shift the burden of proof from the applicant in transmission CPCN proceedings by establishing a rebuttable presumption in favor of a CAISO determination of need, for several reasons.

First, as discussed in more detail in Section V.E, the baseline resources and the identification and analysis of feasible alternatives to a proposed transmission project are critical components of the economic evaluation of the



project. The Commission should retain the ability to assess the adequacy of the applicant's showing in this regard and to maintain consistency among Commission proceedings as we assess alternative means of meeting California's energy needs. However, because of the proprietary nature of the system model and database that the CAISO employs in its economic evaluations, it is not clear that the requirements of §§ 1821 and 1822 and Rule 74 requiring, among other things, that the Commission and parties be able to verify any model and data presented as evidence can be met.

Second, the economic benefits of a transmission project depend inextricably on the project's construction and operating costs. It appears that the CAISO's economic evaluations typically use construction and operating costs provided by the project proponent, with minimal independent review. In a CPCN proceeding, we require that the applicant provide evidence regarding the reasonableness of its cost estimates. In addition, environmental concerns identified during our CEQA review may lead to route alternatives or environmental mitigation measures that may affect project costs. For these reasons, the burden of proof regarding project costs and their impact on project economics should not be shifted from the applicant and a rebuttable presumption regarding the CAISO's analysis of project costs would be inappropriate.

Third, while we agree with and adopt much of the CAISO's TEAM approach, we are not convinced that certain aspects of it are sufficiently developed to ensure reliable economic evaluations of proposed transmission projects. We discuss these concerns in Section V, in which we decline to adopt some of the CAISO's proposed mandatory requirements of TEAM.

Fourth, a transmission project proponent should be required to make a persuasive case to the Commission, regardless of any other party's participation in the CPCN proceeding. Shifting the burden of proof from the applicant to other parties, with potentially less access to resources such as time, money, information, and complex modeling tools, could result in the grant of a CPCN regardless of the quality of the applicant's case, simply because other parties failed to meaningfully challenge the project. The Commission must preserve its ability to deny a CPCN request if it finds the applicant's evidence to be unpersuasive, even in the absence of a strong showing by opponents. It would not be in the public interest to dissipate our ability to reject an unpersuasive showing by granting a rebuttable presumption of need to any party's showing.

For all these reasons, the applicant should retain the burden of proof in CPCN proceedings. The Commission will continue to give appropriate weight to CAISO and all other economic evaluations submitted in CPCN proceedings, based on our review of their reasonableness.

### **C. The Impact and Application of General Principles**

Our adoption today of general principles and guidance regarding economic evaluations of transmission projects will further the goal of greater coordination and consistency between the Commission and the CAISO. The adopted principles and minimum principles should be useful to project proponents, the CAISO, and other parties who may participate both in the CAISO review and in CPCN proceedings before the Commission. Parties who provide economic evaluations to the CAISO that are consistent with our guidelines may also submit them in CPCN proceedings here, thus reducing duplication of efforts, the expense of participating both at the CAISO and here,

and the time required for the two reviews. Additionally, if CAISO review precedes Commission review of a proposed project, parties' experience in defending their project evaluations during the CAISO process should narrow issues and streamline the process in the CPCN proceeding here.

The principles we adopt are applicable to transmission projects proposed wholly or partly on the basis of their expected economic benefits. We recognize that it may be appropriate to tailor the application of these general principles to the particular project before us. As the CAISO notes, the level of analysis required for inter-regional economic projects may be the most substantial and the analysis needed for intra-regional economic projects may be considerably less complex, particularly if the economic impact is limited primarily to a single area. The Assigned Commissioner or assigned ALJ in a CPCN proceeding may allow parties to deviate from the adopted minimum requirements for economic evaluations with good cause shown, taking case-specific conditions into account.

Some transmission projects may be proposed only in part on the basis of economic benefits, and may be expected to have significant other benefits such as enhanced reliability or the ability to deliver power from renewables in furtherance of California's Renewables Portfolio Standard Program (RPS) goals.<sup>4</sup> The principles adopted in today's decision will be applicable in such instances, but we will also consider the other possible benefits in making an overall need determination. Even for a transmission project with significant non-economic benefits, a rigorous economic analysis may be needed, for example, if other projects with different economic benefits could also meet the project's objectives.

Finally, we agree with SCE's suggestion that the applicant in a CPCN proceeding should inform the Commission of a CAISO evaluation of its proposed project, even if it disputes some or all of the CAISO analysis. To the extent it agrees with a CAISO evaluation, the applicant may use the CAISO assessment to help meet its burden of proof. We continue to encourage the CAISO to participate actively in our CPCN proceedings.

#### **D. Future Commission Action**

Because the state of the art in economic evaluations of transmission projects continues to evolve, it is not clear that further investigation at this time aimed at refining the principles and minimum requirements we adopt today would be warranted. Instead, we anticipate that the Commission will assess the applicability of the adopted principles and guidance in the context of individual CPCN applications, as the need arises. As a result, with the adoption of today's decision we close I.05-06-041.

Notwithstanding the case-study emphasis on the DPV2 project in today's order, we do not determine, at this time, the economic need for that project. We will resolve that question in our later decision in A.05-04-015 addressing SCE's CPCN request. At that time, we will consider all of the relevant factors that affect the cost-effectiveness of DPV2, including issues such as fuel cost and load forecasts that we do not address today. We will assess the parties' economic evaluations of DPV2 on their merits, recognizing that our guidance adopted today in I.05-06-041 was not available when the evaluations were prepared.

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<sup>4</sup> See §§ 387, 390.1, 299.25, and 399.11, et seq.

## **V. Principles for Assessment of Economic Benefits of Transmission Lines**

Benefits of a proposed transmission project can be evaluated by comparing estimates of total costs that would be incurred without the proposed project and total costs if the proposed project is built. Such comparisons include assumptions about the resource mix, which may differ in the scenarios with and without the proposed project.

In addition to base case (most likely) scenarios, the effects of possible variations in key factors of the analysis, e.g., load growth or fuel prices, also should be considered in assessing likely economic benefits of a proposed project. Identification and consideration of alternative cases or scenarios as a means of addressing uncertainty is addressed in Section V.B.4.

In economic evaluations of transmission projects, there are three general categories of costs and benefits: (1) the change in total production costs, or energy benefits, (2) changes in other quantifiable economic benefits and costs not included in production cost analyses, and (3) factors whose expected economic effects cannot be monetized. These three types of costs and benefits are addressed in Sections V.B, V.C, and V.D, respectively.

### **A. Benefit Perspectives**

In evaluating a proposed transmission project, assessment of the distribution of potential benefits and costs among geographic areas and among various types of market participants is important. Because of the interconnected nature of the Western electricity system, the relevant geographic region affected by a transmission project may be much larger than the CAISO control area, particularly if the project is an inter-regional upgrade such as DPV2.

All four economic evaluations submitted in this proceeding determined energy benefits based upon production cost modeling of the entire WECC area.

However, parties generally recommend that any Commission-approved methodology rely primarily upon the economic impacts on CAISO ratepayers – rather than WECC-wide economic impacts – in determining whether to grant a CPCN.

In its June 2004 report, the CAISO described the importance of the various perspectives as follows:

A critical policy question is which perspective should be used to evaluate projects. The answer depends on the viewpoint of the entity the network is operated to benefit. If the network is operated to maximize benefit to ratepayers who have paid for the network, then some may consider the appropriate test to be the ratepayer perspective. Others say this may be a short-term view, which does not match the long-term nature of the transmission investment. In the long run, it may be both the health of utility-owned generation and private supply which is needed to maximize benefits to ratepayers. Advocates of this view claim that the network is operated to benefit all California market participants (or for society in general) and, therefore, the CAISO participant or Western Electricity Coordinating Council “WECC” perspectives of benefits may be the relevant test.

If a benefit-cost ratio is greater than 1.0 for one perspective but less than 1.0 for another perspective, the transmission project may transfer benefits from one region or stakeholder group to another.

The CAISO describes that quantifiable benefits of proposed transmission expansions can be evaluated from various perspectives, and describes three particular perspectives: the WECC or Societal perspective, the CAISO Ratepayer perspective, and the CAISO Participant perspective. Benefit-cost ratios can be calculated for other perspectives as well, e.g., for other

geographic regions such as the Southwest or the Northwest, or other groups of market participants such as non-utility generators or municipal utilities.

The WECC or Societal perspective takes into consideration all market participants in the WECC area. It identifies the net benefit to all consumers (or their load serving entities), producers, and transmission owners or holders of transmission rights in the WECC region. The CAISO describes two versions of the Societal benefit-cost test. The basic Societal test includes all producer revenues, whereas what the CAISO calls the Modified Societal test includes only the portion of producer profits derived from competitive prices, and excludes additional producer net revenue obtained from uncompetitive market conditions, i.e., through the exercise of market power. The rationale for the Modified Societal test is that, if producers' market power profits are given the same importance as consumer benefits (as occurs in the CAISO's basic Societal test), transfers of market power-derived profits from producers to consumers as a result of a transmission upgrade would net to zero. The CAISO explains that, to the extent policymakers believe there is value in reducing producer monopoly profits, what it calls the Modified Societal test will be more appropriate than the basic Societal test as a measure of the value of a transmission upgrade.

The CAISO describes that the CAISO Ratepayer perspective focuses on the benefits that would accrue to all parties that are responsible for contributing to the transmission revenue requirement balancing account for the CAISO Participating Transmission Owners (PTOs) and who thus directly or indirectly fund the transmission project. In addition to CAISO consumers, utility-retained generation is included in the CAISO Ratepayer perspective because profits from this generation flow into the balancing account. Transmission owners in the CAISO-controlled grid are also included because their congestion revenues and

revenues received from the sale of transmission rights flow into the balancing account. The CAISO assumes that utility-retained generation does not exert market power, which may be a reasonable assumption. With this assumption, there is no need for a Modified CAISO Ratepayer test.

The CAISO Participant perspective includes CAISO ratepayers plus California merchant generators (independent power producers). No party evaluated DPV2 from this perspective.

### **1. Positions of the Parties**

The CAISO, SCE, PG&E, DRA, and TURN recommend primary reliance on the CAISO Ratepayer test because it focuses on whether a transmission project will yield benefits to those who pay the costs of the project and aligns closely with the group of customers whose retail rates are established by the Commission. These parties generally recommend that results from other perspectives be reviewed as well.

The CAISO evaluated DPV2 using four perspectives: the Societal test, the Modified Societal test, and two versions of the CAISO Ratepayer test. The CAISO's calculations for what it calls the CAISO Ratepayer (LMP Only) test were based on the assumption that a locational marginal price (LMP) market structure and physical flow-based scheduling would be applicable throughout the WECC. However, most of the WECC operates based on contract path (rather than physical-flow network model) scheduling. For the interfaces between the CAISO control area and external control areas, day-ahead scheduling is based on contract paths and interface scheduling limits, and actual conditions may result in congestion that must be mitigated in real time. The CAISO acknowledges that its LMP-based calculation overestimates the loss of congestion revenue due to DPV2 and underestimates California consumer benefits, compared to what may



occur under the scheduling paradigms prevailing now and for the foreseeable future.

The CAISO undertook a second CAISO Ratepayer test for DPV2 to compensate for the inaccuracies of the WECC-wide LMP assumption. The CAISO's simulations for its CAISO Ratepayer (LMP + Contract Path) test for DPV2 utilize selected contractual paths between the CAISO and the Southwest and indicate energy benefits over three times as large as those obtained from its LMP-based calculation. The CAISO believes that these results more closely reflect DPV2 benefits to CAISO ratepayers under current and anticipated WECC scheduling rules. Recognizing some shortcomings to this adjustment as well, the CAISO believes that "the true answer lies somewhere between the CAISO benefits computed with and without this adjustment."

SCE reported results of its economic evaluation of DPV2 from three perspectives: CAISO Ratepayers, WECC-wide, and the impact to Arizona. DRA reported results of its economic analysis of DPV2 only from the CAISO Ratepayer perspective. Since SCE and DRA forecasted market prices based on marginal production costs and did not include any effects of strategic bidding, the adjustments that the CAISO made to its Societal perspective to obtain a Modified Societal perspective would not be applicable to the SCE and DRA analyses. Also, since SCE and DRA analyses were based on contract flows WECC-wide, the CAISO's variations to the CAISO Ratepayer perspective to compensate for inaccuracies in its LMP-based modeling likewise would not be applicable to their analyses.

In addition to the CAISO Ratepayer perspective, DRA proposes that inter-utility equity issues be considered. DRA states that it will be impossible to guarantee that ratepayers of all three major investor-owned utilities (IOUs)

always benefit from a transmission project that provides CAISO-wide benefits. However, it recommends that the Commission verify that no IOU bears a disproportionate share of the project costs. To that end, DRA recommends that IOU-specific benefit-cost ratios be calculated and a project be approved only if no IOU-specific benefit-cost ratio falls below 0.75. SCE and the CAISO maintain that the Commission should license a transmission project if it benefits CAISO customers in aggregate, since its costs will be collected from all CAISO users. The CAISO maintains that, while each project may not benefit all users equally, over time the aggregate projects as a whole should benefit all CAISO customers.

DRA also proposes that the Commission only approve transmission projects that have an expected benefit-cost ratio of at least 1.25 and an undiscounted payback period of 15 years or less. In DRA's view, this requirement would provide some assurance that ratepayers will receive benefits. TURN states similarly that it would like to see a benefit-cost ratio of at least 1.2, but that transmission projects with benefit-cost ratios between 1.1 and 1.2 could be considered if there are significant non-quantifiable benefits. The CAISO asserts that the Commission should consider any transmission project with a benefit-cost ratio greater than 1.0, and should give weight to other factors such as risk reduction, environmental impacts, State policy considerations, local economic impacts, and deliverability of renewable resources. The CAISO opposes any criterion for an undiscounted payback period, arguing that benefits over the entire economic life of the project should be considered.

## **2. Discussion**

No party disputes that the CAISO's standardized benefit-cost methodology is a reasonable approach to measure the economic benefits of proposed transmission projects, and we adopt it to the extent described in this

order. We agree that the perspective of CAISO ratepayers is of primary importance in the Commission's evaluation of a proposed transmission project, since it reflects the effects on customers of the utilities within our jurisdiction. While CAISO ratepayers include some non-jurisdictional entities,<sup>5</sup> consideration of all CAISO ratepayers is an analytical convenience with minor effects on the analysis. We agree with TURN that there is value in reviewing the cost-benefit results from other perspectives as well.

In a restructured energy market that is not fully competitive, producers and traders may garner monopoly rents through the exercise of market power. When the market price is above costs of the least efficient generator whose output is needed to meet market demand, as occurs in a market that is not fully competitive, efficiency is reduced and consumers are harmed. A transmission expansion may improve the import capability over a transmission path and allow access to additional sources of power, thus reducing producers' ability to exercise market power and lowering production costs. Because consumer benefits arise due to this reduction in monopoly power, we view this as an important benefit of a transmission project. If a party models strategic bidding behavior in its economic analysis, the party should reflect the transmission project's effect in reducing producers' monopoly profits as a benefit of the project. For evaluations that include estimates of the effects of strategic

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<sup>5</sup> CAISO ratepayers include some non-Commission jurisdictional customers, including several municipal utilities and public power agencies such as the State Water Project that have joined the CAISO as PTOs. Entities who wheel energy through the CAISO control area and entities with Existing Transmission Contracts whose rates are tied to the PTO transmission revenue requirement also pay Transmission Access Charges and, thus, will also contribute to recovery of the costs of new CAISO transmission projects.

bidding, the Modified Societal perspective, rather than the basic Societal perspective, is the appropriate perspective to use in evaluating the societal benefits of the proposed project.

In CPCN proceedings for transmission projects proposed wholly or partly on the basis of expected economic benefits, the applicant and any other party presenting economic evaluations should analyze benefits from, at a minimum, the CAISO Ratepayer perspective and the Societal perspective. If a party attributes benefits to the proposed project due to mitigation of market power, it should report benefit-cost results using both the Societal and the Modified Societal perspectives. Parties may choose to report benefit-cost results using other perspectives as well.

Consistent with the flexibility we have provided, the Assigned Commissioner or assigned ALJ may require that parties in a transmission CPCN proceeding report benefit-cost results from additional perspectives as appropriate. As an example, the CAISO Participant perspective could provide useful insight regarding the impact of a transmission project on merchant generators within the CAISO area as we consider the need for additional generation near California load centers.

We find the CAISO's development of CAISO Ratepayer (LMP) and CAISO Ratepayer (LMP + Contract) perspectives for DPV2, as explained above, to be very helpful in understanding the intricacies of modeling inter-regional power flows under anticipated market conditions. Any party submitting economic evaluations in transmission CPCN proceedings should explain how it models power flows, constraints, and congestion charges throughout the WECC region, to the extent applicable.

We decline to adopt DRA's inter-utility equity proposal, or a pre-specified benefit-cost threshold or payback period that a transmission project must achieve in order to be granted a CPCN. We expect that transmission projects that individually provide benefits to CAISO ratepayers as a whole will, in the aggregate, benefit customers of each IOU. Additionally, transmission projects may have other benefits and costs in addition to those that can be quantified in a benefit-cost ratio. The Commission will continue to consider and weigh all relevant factors in reaching a decision on a CPCN request.

Parties took differing positions on the discount rate that should be used in calculating benefit-cost ratios. Consistent with our determination in D.05-04-051, the applicant's weighted cost of capital, as adopted most recently by the Commission, should be used as the discount rate in evaluating the benefits of a transmission project. Consistent use of the utilities' weighted cost of capital as a discount rate will facilitate our comparison of proposed transmission projects and alternative investments.

## **B. Quantification of Energy Benefits**

The CAISO, SCE, and DRA all used the CAISO's energy benefits framework to report the change in production costs and thus the potential energy benefits of the studied transmission projects. At the most basic level, energy benefits are the difference between the production costs to serve load in a region without the proposed transmission project and the lower production costs with the upgrade in service. Of course, while transmission upgrades are generally viewed as providing positive energy benefits, this may not be true for all projects or from all perspectives.

A transmission upgrade will lower production costs if it increases market access to economic supply. However, there will be a redistribution of

benefits among consumers, producers, and transmission owners. In particular, a transmission project that increases access to economic power will reduce costs to consumers, thus increasing the consumer surplus. At the same time, the project may reduce income for those generators not accessed by the transmission upgrade, reducing the producer surplus for those generators. It may also reduce transmission owners' congestion revenues and thus the transmission surplus. The energy benefits due to a transmission project consist of the net changes in consumer costs (consumer surplus), producer net income (producer surplus), and congestion revenues flowing to transmission owners or holders of transmission rights (transmission surplus). The sum of the changes in consumer surplus, producer surplus, and transmission surplus equals the change in energy production costs.

The composition of the three components of the energy benefit calculation depends on the geographic area and the market participants' perspective being examined. For example, a WECC Societal benefit calculation would include the effects on all consumers, generators, and transmission owners in the WECC region.

The CAISO Ratepayer perspective considers only changes in consumer procurement costs and generator and transmission profits that affect rates in the CAISO area. From this perspective, the change in consumer surplus is limited to the change in energy procurement costs for consumers in the CAISO area. The change in producer surplus is calculated only for those generation assets owned or controlled by CAISO-area utilities, which may earn less income due to the additional competition from power accessed by the new transmission project. Parties refer to this component of the CAISO Ratepayer benefits calculation as the change in the utility-retained generation producer surplus. Similarly,

PTO-owned transmission assets may earn lower congestion revenues because of the increased flow of power over key transmission interfaces. In summary, energy benefits from the CAISO Ratepayer perspective are the net result of the increase in consumer surplus and changes in the utility-retained generation producer surplus and PTO transmission surplus in the CAISO area.

All parties appear to support the CAISO's conceptual framework as an appropriate representation of the energy benefits of proposed transmission projects. As TURN notes, this framework represents a significant advance in the economic evaluation of transmission lines, since it incorporates changes in congestion revenues, a factor not included in prior analyses. Because it provides a more complete representation of the energy benefits due to a transmission upgrade, we adopt the CAISO's energy benefits framework as reasonable to the extent described in this order.

Parties presenting economic evaluations should report separately the three components of their energy benefit calculations, that is, the changes in consumer surplus, producer surplus, and transmission surplus (congestion revenues), to aid our understanding of their results. This level of detail should be provided for each benefit perspective reported, i.e., the Societal, Modified Societal, CAISO Ratepayer, and any other benefit perspectives reported.

In the following subsections, we address several areas of concern regarding how energy benefit calculations should be performed.

### **1. System Modeling Requirements**

Parties disagree about the type of production cost computer model that should be used to simulate network operation and forecast energy benefits of proposed transmission projects. There are two basic types of production cost

models: network models and transportation models (also called transshipment models).

A network model provides a detailed depiction of the transmission network and forecasts physical flows and nodal prices on the network. Network models can have differing capabilities. An AC-OPF network model is the most complex and most accurate type of production cost model currently available. AC-OPF models typically are used to simulate short periods of time for reliability analyses. Parties agree that it would be expensive and very time-consuming to perform an economic analysis using an AC-OPF model, because of the numerous simulations needed to analyze multiple scenarios and the lengthy time periods to be simulated.

In a DC-OPF network model, simplifying assumptions are made. In particular, a DC-OPF analysis does not model reactive power or variations in voltage magnitudes and phase angles. These simplifications allow a DC-OPF analysis to be less time-consuming than use of an AC-OPF model, but there are tradeoffs in the accuracy of its calculations.

In a transportation model, groups of nodes are aggregated into areas or zones, and power is simulated to flow along simplified contract paths between the zones. The transportation model constrains power flows on paths using specified line limits and multi-line constraints to approximate real-world network constraints. A transportation model calculates zonal prices, whereas a network model calculates nodal LMP prices. To make their complex power flow simulations manageable, network models typically contain a somewhat simplified treatment of generators and their operating constraints, compared to the more detailed treatment of generators that may be undertaken in evaluations using in transportation models.



**a) Positions of the Parties**

The CAISO states that TEAM requires use of a network model, in order to capture the physical constraints of the transmission grid and impacts of a proposed transmission project on locational marginal prices. The CAISO maintains that the production cost simulations must, at a minimum, use a network model derived from a WECC power flow case and perform a DC-OPF analysis that models the physical power flows on transmission facilities for each hourly load and generation pattern. The CAISO states that it is acceptable for a DC-OPF model to compute Power Transmission Distribution Factors (also called shift factors) for every hour of the simulation (variable shift factors), or just for the initial hour (fixed shift factors). Use of an AC-OPF analysis would be optional. The CAISO states that transportation models may be sufficient for many types of resource studies, but maintains that approach is insufficient when analyzing a transmission project that will affect regional transmission flows and locational prices.

The CAISO describes that PLEXOS, the DC-OPF network model it used to analyze DPV2 and Path 26, employs a linearized DC-OPF solution and fixed shift factors, and that transmission constraints are enforced explicitly on high-voltage transmission paths. The CAISO stresses that the requirement to utilize a DC-OPF or AC-OPF production cost model does not constitute an endorsement of any particular vendor or software product, and that many vendors offer an acceptable production cost tool.

The CAISO maintains that use of a transportation model is not acceptable because it computes contract transmission flows instead of physical flows and provides zonal rather than nodal price estimates. The CAISO explains that transportation models cannot model the consequences of loop flow

limitations accurately, and that with transportation models interfaces need to be derated artificially to account for loop flow impacts.

The CAISO states that the execution times required for network models limit the number of simulations that feasibly can be performed at this time, although this limitation may be eased in the future. Because of this limitation, the CAISO recommends that the effects of uncertainty be evaluated using a network model to perform as many discrete sensitivity simulations as possible. The CAISO asserts that the larger number of sensitivity cases that can be examined using a transportation model will not enhance the quality of a study because the underlying physical transmission system is not modeled accurately.

SCE, PG&E, SDG&E, DRA, TURN, and Global Energy unite in recommending that the Commission not require use of a network model for the analysis of energy benefits. SCE and DRA used the Global Energy transportation model in evaluating the economic benefits of DPV2.

SCE submits that the utility's choice as to which computer model to use in a particular certificate proceeding may be influenced by a variety of factors, including price, staff availability, regulatory familiarity, and adaptability to a particular project. SCE agrees with the CAISO that it is important to verify that simulated power flows are physically realistic, but maintains this can be done with transport modeling, using power flow models and nomograms such as the Southern California Import Transmission (SCIT) nomograms.<sup>6</sup> SCE describes that the network representation in its economic analysis of DPV2 incorporated SCIT limits to reflect operational constraints and ensure that flow is

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<sup>6</sup> A nomogram is a chart showing the operational limits for simultaneous use of a set of particular transmission lines.

physically feasible. SCE also performed power flow analyses to demonstrate the physical feasibility of the modeled power flows. SCE concludes that its simulations using a transportation model produce reasonable forecasts of market prices and DPV2 economic benefits.

PG&E's position is that use of transportation models should be allowed, since selected power flow studies and known operational limits can be used to validate the results obtained using a transportation model.

SDG&E asserts that transportation models have certain advantages over network models. It would like to maintain the flexibility to use transportation models. SDG&E reiterates its overall position, however, that the Commission should grant deference to the CAISO's need determinations regardless of the particular model that is employed in obtaining the CAISO's approval for a project.

TURN would prefer to see both network and transportation models employed in certificate proceedings to the extent that time and resources permit, since both types of models have strengths and weaknesses. TURN submits that decision makers can act with greater confidence when both approaches produce the same end result. TURN comments that, if parties' showings using the different types of models produce markedly different results, that would be cause to delve more deeply and seek to determine why that is the case.

Global Energy does not consider the PLEXOS model, as used by the CAISO, to be a "true" DC-OPF model. It asserts that a network model that uses fixed shift factors is less accurate than a properly designed transportation model. In Global Energy's view, the Commission should require that a network model, at a minimum, use variable shift factors and that it model non-linear

elements of the grid, namely, DC lines and phase-shifting transformers. Global Energy also submits that it is not clear that the CAISO's model reasonably reflects generation unit commitment and dispatch.

**b) Discussion**

We agree with the CAISO that it is important to achieve reasonable accuracy in forecasting energy production costs, energy prices, and congestion costs. At the same time, we are not convinced by its arguments that only network models can provide an acceptable level of accuracy in this regard.

We note the assessment of the CAISO Market Surveillance Committee that transportation models have certain advantages and their use may be acceptable under certain conditions:

[W]e believe that any estimation of transmission benefits should rely upon a full network model, unless computational experiments under a representative range of cost and demand conditions show that little bias results from using a simpler [transportation] model. If indeed there is little such bias, then a [transportation] model may have significant computational advantages, allowing consideration of a more complete range of fuel price, demand, hydrological, and equipment outage scenarios. However, in the absence of a demonstration that insignificant bias results from network simplification, a full network model based upon, at a minimum, a linearized DC load flow should be adopted.

As the record shows, both network models and transportation models have advantages and disadvantages. Because of their more detailed and realistic modeling of the transmission system, network models can provide more accurate forecasts of physical flows on the network and can pinpoint congestion

and, in an LMP market, its economic implications with more certainty compared to a transportation model.

At the same time, a simpler transportation model is computationally faster and allows a more complex analysis of uncertainty, including the ability to perform stochastic analyses of the effects of variability in key factors. Parties point out that economic evaluations using transportation models generally provide more sophisticated modeling of generation resources than those using a network model. Global Energy also raised concerns regarding the accuracy of the CAISO's network model due to its use of fixed shift factors and linear modeling of non-linear system elements.

The CAISO acknowledged the view of the CAISO Market Surveillance Committee that use of a transportation model may be advantageous if separate calculations show that it exhibits little bias. However, the CAISO categorically rejected the use of transportation models, without providing evidence regarding steps that may be taken to verify the adequacy of the results. Nor did it provide evidence regarding the adequacy of the particular steps SCE took in its DPV2 study using power flow analyses and the representation of SCIT nomograms to reflect operational limits.

The anticipated move to an LMP market design for the CAISO may affect the relative desirability of network versus transportation models. The CAISO asserts that a network model is better at modeling an LMP market because it forecasts prices at the nodal level. But, as the CAISO acknowledges, a network model based on physical flows may exhibit significant inaccuracies in scheduling and the allocation of congestion revenues on the interfaces between CAISO and non-LMP areas. Transportation models may provide more accurate modeling of generator operating constraints, but need independent verification

regarding the effects of loop flow and the consequent development of prices and line-specific congestion.

In I.00-11-001, the Commission relied on an analysis undertaken for SDG&E by Henwood Energy Services (Henwood, now Global Energy) in assessing economic benefits of proposed Miguel-Mission and Imperial Valley upgrades. Global Energy explains now that its analysis in I.00-11-001 used transportation modeling capability comparable to that utilized by SCE and DRA in this proceeding to evaluate DPV2. In D.03-02-069, we found the Henwood modeling approach to be reasonable and expressed that we were not concerned “that the modeling effort conducted here represents a simplified tool that must be properly benchmarked against more sophisticated models in order to assure confidence in its use.” We remain unconvinced that benchmarking efforts cannot be sufficient to allow reliance on the results of transportation models.

We are likewise unconvinced that the state of the art in modeling the transmission and generation system is such that one type of system model should be required and another rejected. We do not accept the CAISO’s position that a network model must be used in an economic evaluation of a proposed transmission project. Instead, we will continue to allow the applicant to choose the type of system model to use to support need for its proposed transmission project. DRA’s proposed principle regarding the assessment of energy benefits is most useful in this regard, and we adopt a slightly modified version, as follows:

Parties shall assess energy benefits using an established, credible, and commercially-available production cost modeling tool. Computer modeling access requirements of §§ 1821 and 1822 shall be met consistent with Rules 74 and 87.

As is now the case, the applicant and any other party submitting economic evaluations in a CPCN proceeding must demonstrate the reasonableness of their modeling efforts. To that end, in their economic evaluations parties should address the accuracy with which their chosen models reflect system operations and market prices under expected market structures, including the modeling of generation unit commitment and dispatch and the modeling of power flow, constraints, and congestion charges both within the CAISO control area and in other areas included in their analyses.

## **2. Consideration of Market Power and Strategic Bidding**

Expansion of the transmission system may increase the total supply that can be delivered over a transmission path and the number of suppliers that can be accessed to serve load. This allows more efficient production and, in a restructured market, can provide further economic benefits to the extent it reduces the ability of producers to exercise market power. However, parties disagree regarding the desirability of forecasting a proposed transmission project's effect in reducing generators' market power.

### **a) Positions of the Parties**

The CAISO recommends that the assessment of economic benefits of a proposed transmission project include the modeling of strategic bidding and the project's effects in reducing producers' market power and thus consumers' costs. The CAISO states that if a transmission project is shown to be strongly economic under cost-based conditions, with Societal and CAISO Ratepayer benefit-cost ratios over 1.5, it would be reasonable to allow the proponent to choose not to perform a strategic bidding analysis. For other projects proposed for economic reasons, the CAISO maintains that the project

proponent must model strategic bidding. The CAISO would not restrict the types of modeling techniques that parties could utilize, except to require that system conditions be reflected dynamically on an hourly basis. The CAISO recommends that some type of benchmarking occur, as an indication of how well the proposed bid strategies perform in predicting either current or historical regional prices.

In both its Path 26 and DPV2 analyses, the CAISO used an empirical econometric approach to forecast the result of strategic bidding. The CAISO estimated the historical statistical relationship between market-clearing price-cost markups and two variables that measure system supply and demand conditions: the percentage of load that is unhedged, that is, not under forward contract, and the Residual Supply Index. The Residual Supply Index reflects the total supply available to meet load without the largest supplier. The CAISO estimated this statistical relationship between price-cost markups and the two supply/demand measures using CAISO market data from two periods: 1999 to 2000 when suppliers had few long-term contracts with load, and 2002 when some suppliers had large amounts of supply under long-term contracts. The CAISO estimated the relationship of how market-clearing prices were marked up above cost every hour in each of three California regions (south, central, and north). Using that information, the CAISO built a dynamic bid adder mechanism in its market simulation model, according to which merchant suppliers' bids are estimated based on their production costs and market conditions.

While preferring an empirical approach, the CAISO describes that other methods can be used to model strategic bidding behavior, including a game-theoretic approach in which strategic suppliers seek to maximize profits by changing their bidding in response to the bidding strategy of other players.



SCE and DRA do not model strategic bidding to estimate benefits of DPV2 due to its mitigation of market power. In its opening brief, SCE takes the position that modeling of strategic bidding should be optional and that the Commission should not require a specific methodology, since the applicant in a CPCN proceeding has the burden of proof. In prepared testimony, SCE viewed efforts to model market power with skepticism:

Modeling of market power is an unbounded problem because one can't rely on anything factual. The reduction in market power is a positive benefit, but the absolute value of the benefit can't be quantified. (Ex. 9 at 7.)

Global Energy agrees with the CAISO that it would be desirable to reflect bidding strategies in an analysis of the economic benefits of transmission projects if cost-based studies do not show that a project will bring net benefits. In its view, however, the CAISO's approach to bidding strategies must be refined and undergo further testing before it can be accepted. Global Energy cites concerns by the CAISO Market Surveillance Committee that further work is needed, as well as its own concerns about the lack of data from the entire WECC market, possible misspecification of the econometric model, and a poor R-squared measure of model accuracy.

BAMx agrees with the price-cost and bid-cost markup methodology used by the CAISO and recommends that the Commission adopt it.

## **b) Discussion**

No party in this proceeding has disputed that transmission expansions can mitigate generator market power. However, the difficulty lies in quantifying the value of that reduced market power in terms of reduced energy prices. The evidence in this proceeding demonstrates that attempts to quantify

the benefits of market power mitigation are extremely complex, and that it is difficult to confirm the extent to which they produce reliable results.

Consequently, we are not persuaded that an applicant should be required to forecast the proposed transmission project's impact on strategic bidding behavior and market prices. The CAISO suggests a threshold market power study requirement if cost-based benefit-cost ratios are below 1.5; we are not convinced of the value of such a threshold. As SCE reminds us, the applicant has the burden of demonstrating need for its proposed project. We believe that the applicant should be allowed to determine whether to include information regarding market power mitigation benefits to meet this responsibility.

There is general agreement that the forecasting of bidding strategies is a very complex undertaking. The CAISO Market Surveillance Committee has noted the difficulty of modeling such behavior:

The interaction of transmission constraints and market prices is an extremely complicated process that is difficult to model. Over the last decade there has been quite a bit of research into methods for modeling imperfect competition in electricity networks and several approaches have been developed. Unfortunately, the process of vetting and empirically testing these approaches has just begun. (Att. 17 to Ex. 13 at 7-8.)

While the CAISO has made significant strides in developing a dynamic bidding strategy algorithm in an attempt to quantify the benefit of market power reduction, we have several concerns about the CAISO methodology as submitted in this proceeding. An initial observation is that the methodology has not been thoroughly vetted. The only applications to date of the CAISO's dynamic bidding strategy methodology are the Path 26 and DPV2

studies submitted in this proceeding, with the CAISO making several refinements when it undertook the DPV2 study. The CAISO is not aware that any other entity has engaged in such an undertaking, and acknowledges that “much research and development remains to be done in this area” and that further enhancements of its market price methodology are “both important and necessary.”

We question the consequences of the CAISO’s use of historical data to predict generator bidding behavior in the anticipated LMP-based market. Because the LMP market design has not yet been implemented in the CAISO control area, the CAISO has no experience with an LMP-based market to inform its analysis. Both the CAISO and the CAISO Market Surveillance Committee recognize that this is a potential shortcoming of the CAISO’s approach to modeling bidding strategies. Additionally, the combination of the market power mitigation measures in the LMP market design and the large portions of supply that will be under contract as a result of the Commission’s resource adequacy and long term procurement requirements will tend to reduce the ability of producers to exercise market power. The CAISO’s historically based strategic bidding algorithm does not reflect these fundamental changes in market design or their effect in reducing the extent to which new transmission projects may mitigate market power.

Another concern is that the reasonableness of the CAISO’s use of derived market-wide price-cost markups to approximate individual generators’ bid-cost markups has not been established. The CAISO Market Surveillance Committee has opined that it is very difficult to estimate econometrically unit or even firm-specific bid mark-ups. The CAISO had only limited information on bidding behavior of suppliers, since it relied upon information provided by the

CAISO's real-time markets, which account for only a very small portion of wholesale energy sales in the CAISO control area (less than 5% in 2003). The CAISO acknowledges that some calibrations may be needed when price-bid markups are used as a proxy for bid-cost markups, but did not undertake such an effort in its evaluation of DPV2.

Similarly, the CAISO has not established the predictive ability of its chosen regression specification. As Global Energy noted, the R-squared value of 0.46 for the CAISO's chosen equation provides only limited assurance in this regard. The CAISO chose its regression equation based on a qualitative comparison of the predictive ability of three candidate equations using five days of historical market data from July 2003. We would like to see a more rigorous analysis of the predictive ability of bidding strategies submitted in support of a proposed transmission project.

Global Energy describes that, while SCE and DRA did not use this capability in their DPV2 analyses, its transportation model contains a method for modeling bidding strategies and market power. Global Energy states that in D.03-02-069 the Commission reviewed and accepted the Henwood analysis of the effects of market power as part of its evaluation of the Miguel-Mission and Imperial Valley upgrades. Global Energy asks the Commission to find that its methodology for modeling market power continues to be reasonable.

The record in this proceeding is insufficient for us to pass judgment on Global Energy's methodology for modeling bidding strategies and market power. In D.03-02-069 the Commission found the Henwood analysis of the Miguel-Mission and Imperial Valley projects to be reasonable. The Commission did not address the reliability of the market power (then called the

scarcity premium) component of the Henwood analysis, commenting only that the scarcity premium came into play during very few hours. In this proceeding, Global Energy provided only a brief description of its approach to modeling bidding strategies and market power, characterizing it as a rational behavior-based approach. Lacking a detailed record in this proceeding regarding the Global Energy modeling of bidding strategies and market power or whether Global Energy has modified its approach since its evaluation of Miguel-Mission, we cannot make findings at this time regarding the acceptability of Global Energy's methodology.

In summary, market power mitigation can be an important benefit of transmission projects, but a benefit that may be difficult to quantify reliably. Any party submitting an economic evaluation in a transmission CPCN proceeding that includes impacts of the proposed project to lessen market power should include a complete description of its bidding strategy methodology and steps taken to validate its predictive ability in anticipated market conditions. The party should also submit a comparable economic analysis that does not model strategic bidding or market power mitigation benefits, so that the Commission can evaluate both the manner in which the market power mitigation analysis is performed and its effect on the economic justification for the project.

### **3. Other Modeling Assumptions and Simplifications**

The parties' efforts to model the economic impacts of the Path 26 and DPV2 transmission projects, while perhaps the most complex ever presented for a transmission project, entail numerous assumptions and simplifications. In some instances, simplifications are necessary due to modeling limitations. Other modeling choices may be made because of resource or time constraints.

Parties that submit economic evaluations in CPCN proceedings should identify significant assumptions and simplifications, the reasons for those choices, and the biases and possible effects on their study results. While it may not be possible to quantify the effects of many assumptions and simplifications, the parties should provide as much information as possible, both quantitative and qualitative, about the likely magnitude and direction of such effects.

As mentioned above, parties should address the impacts of modeling choices that affect power flows and congestion revenues, as well as generation unit commitment and dispatch. We describe here several other assumptions and simplifications made in DPV2 evaluations about which concerns have been raised in this proceeding, and which by their nature also appear likely to be at issue in other CPCN proceedings.

**a) Contracts and Ownership of New Generation Facilities**

In system simulations performed for their DPV2 evaluations, SCE and the CAISO assume that all energy is bought and sold at spot market prices. DRA is concerned that this modeling simplification tends to overestimate consumer surplus benefits, because it credits the transmission project with price reductions for all energy sold. DRA points out that, in reality, much of the utilities' energy needs is met by power contracts or cost-of-service generation whose costs to ratepayers are either partially or entirely insensitive to market prices and immune to exercise of market power.

SCE and the CAISO justify their use of this modeling choice because of difficulties in predicting future contract terms. They downplay possible impacts of this simplification on the basis that, in the long run, contract prices should track expectations regarding the market price, subject to risk

considerations. They also state that, to the extent that consumer surplus benefits may be overstated due to use of spot market prices, there may be offsetting impacts in the generator and transmission surplus calculations that may mitigate or even eliminate the purported overstatement.

As a related concern, DRA criticizes SCE's analysis of DPV2 in that it assumes that no new generating units will be owned by CAISO utilities or controlled by CAISO utilities under a power purchase contract. DRA contends that SCE's assumption biases the results because it underestimates the reduction in URG producer surplus due to the new transmission project and, thus, overestimates the benefits of the transmission project to CAISO ratepayers. DRA notes that PG&E is currently proposing to complete construction of the Contra Costa 8 unit<sup>7</sup> and that PG&E issued two Requests for Offers in 2005 that sought turnkey bids that would enable PG&E to take ownership of additional new resources. DRA also believes that, given the Commission's physical resource adequacy requirement, the utilities will enter new power contracts in the future that give them control over specific generating units, including such units' revenues. DRA comments that the municipal utilities that are CAISO PTOs also are likely to own or control new generating unit revenue streams in the future.

We agree with DRA that such aspects of economic evaluations should be reviewed with particular care. While the need for modeling simplifications is understandable, the effect of such simplifications on the ability to forecast system operations reliably under anticipated market conditions must be addressed. In all economic evaluations submitted in CPCN proceedings,

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<sup>7</sup> In D.06-06-035, the Commission granted PG&E a CPCN for the Contra Costa 8 facility.

parties should identify their modeling assumptions about bilateral contracts and ownership of new generation, and should address possible impacts of such assumptions on study results.

**b) Number of Years Studied and Extrapolation of Results**

In its TEAM approach, the CAISO states that at least two years of system operations must be evaluated. The CAISO would require that the two years studied be at least five years apart. The CAISO conducted its analysis of DPV2 for 2008 and 2013. Although SCE expects DPV2 to become operational in 2009, the CAISO used 2008 for its first year of analysis, and 2013 as the second year because those were the two years for which the CAISO was able to obtain a representation of the network and associated data from SSG-WI.

Using forecasted 2013 energy benefits, the CAISO assumed a 1% real (adjusted for inflation) escalation rate for energy benefits after 2013. The CAISO performed sensitivity calculations which indicated the change in levelized energy benefits if a negative 1% real escalation rate or a positive 3% real escalation rate is assumed instead.

SCE performed production simulations for a study period beginning with DPV2's proposed operating date of June 1, 2009 through 2014, and forecasted that benefits would continue with zero real growth beyond 2014.

We agree with the CAISO that at least two years should be modeled, with the years chosen several years apart. We prefer, however, that analyses also simulate the intervening years, particularly if there are significant system changes, e.g., large transmission or generation additions or retirements, during those years. DRA notes that 61% of the present-value benefits that SCE projected due to DPV2 occur during the four and a half years it modeled. We



agree that there would be limited value to undertaking detailed simulations much beyond five years of initial operation, due both to increasing uncertainty regarding market conditions as time progresses and to the fact that energy benefits during the later years will be increasingly discounted in present-value benefit calculations.

Any party submitting an economic analysis in a transmission CPCN proceeding should justify the number and choice of years to be simulated. It should also explain and justify the method for estimating benefits for years for which simulations are not undertaken, including any years before and those years after the last year simulated. The party should also provide sensitivity analyses such as those the CAISO submitted for the effects of different assumptions about benefits in years that are not simulated.

### **c) Time Period Studied Each Year**

The CAISO would require chronological modeling in which at least 12 weeks per year and at least 168 hours per week would be simulated. It recommends that the entire year (8,760 hours) be simulated, as it did for DPV2. The SCE analysis of DPV2 simulated a typical week each month, and every fourth hour in each of the typical weeks, to reduce simulation times. DRA submits that SCE's approach tends to overestimate a transmission project's value, because it causes the appearance that outages occurring during the simulated week last the entire month.

In an economic evaluation, the party should identify the number of hours studied each year and, if the entire year is not simulated, should address any impact the choice not to simulate all hours may have on study results.

We note that a party with resource or time constraints may make trade-offs in how it undertakes an economic evaluation. The CAISO stated that it

views additional sensitivity cases to be more important than simulations of multiple sequential years. At the same time, in evaluating DPV2 it chose to study all hours of the year. SCE chose to limit the number of hours studied, but performed a stochastic analysis with 100 simulations of four and a half years of system operations. Resource constraints may affect other choices as well, such as whether to use a network model or a transportation model. Each party submitting economic evaluations should address the extent to which resource or time constraints affected its study design choices, including but not limited to the type of model used, the number of years and the number of hours per year studied, and the number of scenarios or stochastic iterations performed. Each party should address the basis for any resulting trade-offs it made among such study attributes. This will allow the Commission to better understand the parties' showings.

#### **4. Uncertainty Analysis**

Because of the long-lived nature of the investment, economic evaluations of proposed transmission projects require judgments and assumptions about system and market conditions for many years into the future and even the best forecasts are inherently uncertain in this respect. As a result, it is essential that economic evaluations consider how uncertainty about future system and market conditions affects the likelihood that a project's forecasted benefits will be realized.

The impact of risk and uncertainty on economic benefits associated with transmission expansions can be assessed using deterministic, scenario, and/or stochastic approaches. A deterministic analysis would rely on a system simulation using expected forecasts of critical parameters that would affect the magnitude of benefits to be obtained due to the project. Factors such as system

load, fuel prices, and hydrological conditions may be critical parameters in economic analyses of transmission projects. A scenario analysis would undertake multiple simulations using predetermined combinations of forecasted values for such key variables and, if relative probabilities are assigned to the individual scenarios, would allow calculation of probability-weighted expected benefits. In contrast, a stochastic analysis would develop probability distributions for the key parameters such as fuel prices and would then perform repeated system simulations using values for the key parameters chosen by randomly sampling the values from the probability distributions. Such a stochastic analysis is often referred to as a Monte Carlo analysis.

We agree with the CAISO that it would be overly prescriptive and counterproductive to mandate the methodology to be used in performing uncertainty evaluations. As the parties' sensitivity analyses for DPV2 demonstrate, whether scenario or stochastic sensitivity studies are appropriate may depend to some extent on the type of system modeling tool that is chosen, e.g., a network model or a transportation model. It is appropriate, however, to provide certain guidance regarding the types of uncertainty that should be considered and the scope of the showing that we expect.

The CAISO would require sensitivity analyses only if the Societal benefit-cost ratio for a proposed project under what the applicant considers to be base case conditions is less than 1.5. We are not comfortable with use of such a threshold. As the DPV2 analyses demonstrate, benefit projections can vary widely based on relatively minor variations in key parameters and modeling conventions. We require that any applicant requesting a CPCN for a transmission project justified wholly or partly on the basis of economic benefits submit an uncertainty analysis consistent with the guidelines we adopt today.

While using very different approaches, SCE and the CAISO provided probabilistic economic analyses of DPV2. SCE performed 100 stochastic simulations varying hydro conditions, natural gas prices, and demand conditions according to assigned probability distribution functions for each variable. In contrast, the CAISO analyzed 17 market-based scenarios which, in addition to load, gas price, and hydro variations, also considered that merchant generators alternatively exhibited low, base case (derived from the regression analysis described in Section V.B.2), or high levels of market power in their bidding strategies. SCE and the CAISO each used its results to calculate probability-weighted expected future benefits of DPV2.

While we will address the results of the parties' economic analyses of DPV2 in a later order in A.05-04-015, it is clear that such probabilistic studies are very helpful in understanding the potential effects of uncertainty on large transmission investments. Recognizing that probabilistic studies may be expensive, we require that any applicant proposing a transmission project expected to cost more than \$100 million and justified at least in part on the basis of expected economic benefits provide a probabilistic analysis of the effects of uncertainty on the expected benefits of the project. Such an analysis should consider a reasonable range of possible variations in key parameters that may affect economic benefits significantly. We do not specify the parameters that should be considered or the type of probabilistic analysis, e.g., scenario or stochastic, that should be undertaken. However, the inputs and corresponding results of individual cases (whether stochastically or manually derived) should be provided as part of the submitted economic evaluation.

Contingency events may affect the cost-effectiveness of a transmission project in either a positive or negative manner, but it is difficult to

assign a probability to them. Transmission projects may provide insurance value for high-risk contingency events. At the same time, there may be downside risk that unexpected market developments may render a transmission investment uneconomic. For DPV2, the CAISO analyzed eight market-based contingency scenarios representing extreme or unlikely transmission and generation events. DRA likewise analyzed eight sensitivity scenarios having no assigned probabilities, including extended outages of the Palo Verde nuclear units, no differential between Arizona and southern California natural gas prices, the addition of a 1,000 MW solar installation that interconnects at the proposed Midpoint substation on the DPV2 line, a delay in the retirement of California generators, alternate assumptions about capacity expansions in Arizona, extended outages of the San Onofre nuclear units, higher natural gas prices, and construction of 1,250 MW of combined cycle plants instead of DPV2.

Parties presenting uncertainty analyses should address a reasonable range of contingency events. Parties should address both contingency events whose possible economic consequences may be quantified (providing both the inputs and corresponding results for each such contingency event analyzed) and those whose consequences may be addressed only in a qualitative fashion. We do not specify the contingency events that should be considered, since they are likely to vary depending on the transmission project under consideration.

DRA is concerned that model complexity poses a major barrier to understanding parties' analyses. DRA recommends that the Commission direct applicants to submit a deterministic reference case and specified sensitivity cases to illustrate the impact of changes in major variables on project valuation. For similar reasons, the CAISO proposed in its prepared testimony that all parties submitting economic evaluations of a transmission project be required to analyze

at least one cost-based reference case using the SSG-WI database, to facilitate comparison of different parties' analyses and help identify the cause of differing results.

As DRA and the CAISO suggest, establishment of reference cases would assist the Commission's evaluation and comparison of parties' economic analyses. We have found DRA's reference cases particularly helpful in understanding differences between its and SCE's evaluations of DPV2.

We require that each party submitting an economic evaluation provide at least one cost-based (that is, without strategic bidding) deterministic reference case, subject to the following guidance, in order to facilitate understanding of its chosen methodologies and comparison with other parties' showings. The applicant should use its baseline resource plan and assumptions about the system outside its service territory from procurement or other recent Commission proceedings, as described in Section V.E, and what it views as most likely forecasts of key variables such as fuel prices, demand, and hydro conditions. The applicant should provide a detailed description of its reference case and should provide access to its database (as is required by §§ 1821 and 1822 and Rule 74). Other parties should submit a cost-based deterministic reference case that mirrors the resources and other key assumptions in the applicant's reference case to the extent feasible, consistent with that party's chosen model and methodologies. Any party that models strategic bidding should also submit a market-based reference case that varies from its cost-based reference case only in its inclusion of strategic bidding, so that the effects of its modeling of market power mitigation benefits are clearly delineated. We encourage parties to submit additional reference cases, for example, to help illuminate differences among parties' positions on modeling issues and input assumptions.

We decline to require use of the SSG-WI database in the parties' reference cases, because of the need to maintain consistency with resource plans used in other Commission proceedings. There are also concerns about compatibility of the SSG-WI database with non-network models and its maintenance and accessibility following its recent transfer to the WECC. We are willing, however, to revisit the use of SSG-WI data in future CPCN or other relevant proceedings.

DRA proposes that applicants be required to submit a tipping point analysis, such as DRA provided for DPV2. DRA notes that there may be a small number of pivotal factors in which slight changes can drive the economics of the project from positive to negative. DRA recommends that parties be required to identify clearly which parameters, assumptions, or relationships most affect their conclusions. Once tipping point factors are determined, DRA recommends that the next step would determine the tipping point value (or "knife edge") for each factor, above (or below) which the proposed project would not be economically beneficial.

Regarding DPV2, DRA identified four variables as tipping points: modeling conventions, the natural gas price differential between Arizona and California generators, the on-line status of the Palo Verde nuclear units, and the wholesale cost of natural gas. Due to time constraints, DRA was not able to perform a "knife edge" analysis for these variables.

We agree that there is value in understanding the critical factors in a party's economic evaluation. As DRA suggests, we require that each party identify which parameters, assumptions, or relationships most affect the conclusions in its economic evaluation. We encourage but do not require an explicit tipping point analysis such as DRA submitted for DPV2.

In addition to near-term uncertainty, DRA emphasizes that the farther a forecast extends into the future, the more likely it is to be wrong, particularly given the potential for major paradigm shifts in the production, distribution, and consumption of electricity. DRA proposes an Uncertainty Margin methodology as a way to quantify the robustness of benefit-cost calculations to forecast risk. The requirement adopted in Section V.B.3.b that parties indicate the effect of different escalation rates for energy benefits after the last year simulated has much the same effect and so we do not adopt DRA's proposal for a separate Uncertainty Margin analysis.

### **C. Other Quantifiable Economic Benefits and Costs**

In addition to expected energy benefits and project costs, other potential economic benefits and costs of a proposed project may be identified and quantified. The CAISO recommends, but would not require, that economic benefits in addition to energy benefits be quantified and included in a benefit-cost analysis, to the extent feasible. It states that proponents should have flexibility to offer credible methodologies for determination of such benefits.

Parties have identified the following non-energy attributes that may have economic benefits or costs that may be quantified and thus included in an economic assessment:

- Reductions in operating costs,
- Changes in system losses,
- Environmental benefits or costs,
- Capacity benefits,
- Capital and other costs or benefits resulting from resource substitution, and



- Increased transmission revenues from CAISO wheeling service and Existing Transmission Contracts.

To the extent parties estimated the value of these benefits attributable to DPV2, we will assess those estimates in our later decision in A.05-04-015.

In its economic evaluation, an applicant should identify and, if possible, quantify the economic impacts of any attributes of its proposed transmission project or its operation that may increase societal costs or have other detrimental effects. The importance of quantifying non-energy economic benefits depends, to some extent, on whether identified energy benefits provide sufficient justification for the proposed project. We encourage parties, however, to provide such information so that we may consider as fully as possible all important attributes of the proposed project. If a party quantifies non-energy benefits and costs, the party should report separately the amount of each such attribute of the proposed project. Parties may include these factors in their uncertainty analyses, to the extent appropriate.

The cost of a proposed transmission project is an integral component of any economic evaluation. Each party should specify the level of project costs (including capital and operating and maintenance costs) assumed in its economic evaluation, and how a change in project costs would affect cost-effectiveness results. In particular, any party presenting benefit-cost analyses should specify, through a formula if appropriate, how a change in project costs would change any benefit-cost ratios or other benefit-cost results in its economic evaluation.

In its opening brief, BAMx argues that the Commission should develop the long-term cost of entry for new capacity for various regions within California. We do not address the BAMx proposal because, in addition its untimeliness, this proceeding is not an appropriate place for its consideration.

**D. Non-monetized Considerations**

In order to allow full consideration of a proposed transmission project, the applicant should apprise the Commission of any detrimental aspects of the project whose economic impacts cannot be quantified. We encourage parties to also address any economic benefits that may be difficult to measure. As examples, parties have identified the following considerations that may be relevant to a proposed transmission project and whose benefits or costs may not be quantifiable:

- Access to renewable resources,
- Non-monetized environmental impacts,
- Fuel diversity benefits,
- Reliability impacts,
- Enhanced system operational flexibility,
- Mitigation of market power, to the extent not quantified,
- Potential for increased reserve resource sharing, and
- Job creation or losses.

The Commission will consider such non-monetized aspects of the proposed project, along with other relevant factors, in assessing an applicant's CPCN request.

**E. Resource Plans and Alternatives to a Proposed Project**

The applicant's resource plan and assumptions about transmission and generation resources in other portions of the study area are important components of the economic evaluation of a proposed transmission project. An economic assessment should take into account other potential changes to the system that may accompany construction of the proposed project. It should also

consider alternative resources that could be added or implemented in lieu of the proposed transmission project.

In its economic analysis of DPV2, SCE used the system database it maintains for the Commission's long term procurement proceedings, with updated forecasts for loads, natural gas prices, and available hydro generation. SCE describes that, for inclusion in its baseline resource plan, construction of other transmission projects should be fairly certain, with entities sponsoring the new transmission taking affirmative steps toward construction such as entering projects in the WECC rating process, making monetary investments like purchasing land or major facilities, or applying for necessary regulatory permits necessary to construct.

SCE's criteria for inclusion of a generation project include that it must either be substantially constructed and have financing completed, or be an investor-owned or municipal utility project. SCE's baseline resource plan included increased energy efficiency and demand response, as well as renewables to meet or exceed the State's 20% RPS goal. SCE removed generation based on published retirement dates, if a plant reaches a life of 55 years, if retirement is planned due to air quality restrictions, or if retirement is consistent with Commission planning assumptions. SCE suggests that developing the DPV transmission corridor could attract new generation development east of the Devers substation and that DPV2's benefits could increase due to the increased access to new generation. However, SCE did not model or quantify this purported benefit.

SCE describes that it evaluated several potential transmission projects that could increase transmission import capability into California. The identified

projects were screened using rough estimates of project costs and deterministic production simulations before the DPV2 project was chosen.

In its DPV2 analysis, the CAISO modeled the transmission and generation system using the SSG-WI database, modified after lengthy discussions with SCE to improve its representation of the SCE system. The CAISO describes that it also added generation resources to the SSG-WI database to reflect estimated RPS goals in each state, and added new gas-fired generation, primarily combined cycle plants, in each of the WECC areas as needed to maintain at least a 15% planning reserve margin.

The CAISO describes its intent to plan the transmission grid taking into account the profitability of generation additions in various locations. The CAISO explains that, in this way, it will influence generation decision making, rather than accounting for generation additions after the fact. Under this approach, the CAISO would model the profitability of new generation and would optimize generation additions for “with upgrade” and “without upgrade” cases. The CAISO states that it would attribute to the proposed transmission upgrades the benefits and costs of resources alternatives that are economic in the “with upgrade” case but not viable in the “without upgrade” case. However, the CAISO did not optimize generation additions in its economic evaluation of DPV2. Instead, the CAISO used the same resource plan for its “with DPV2” and “without DPV2” simulations.

The CAISO’s view is that both additional generation in southern California and inter-regional transmission upgrades should be pursued. Thus, it did not evaluate new generation projects in southern California as an alternative to DPV2.

DRA based its economic evaluation of DPV2 on SCE's resource plan assumptions, with certain modifications. DRA notes one difference between the baseline resource plans developed by SCE and the CAISO: the CAISO included a series capacitor upgrade sponsored by the Salt River Project, whereas SCE did not. DRA expects that inclusion of that upgrade in SCE's (and therefore DRA's) analysis would reduce the indicated economic benefits of DPV2. However, DRA did not opine on whether SCE should have included that upgrade in its baseline resource plan. DRA explored several other sensitivity scenarios modeling possible changes to SCE's resource plan.

The importance of well-developed and clearly justified baseline resource plans is not unique to CPCN proceedings. In order to allow consistency among Commission proceedings, the applicant in a CPCN proceeding should use a baseline resource plan and assumptions about the system outside its service territory that are consistent with its resource plan and system assumptions used in procurement or other recent Commission proceedings. In its showing, the applicant should identify clearly and explain any changes to its baseline resource plan or to prior assumptions about transmission and generation resources in other parts of the study area. The applicant should also specify the criteria it used to determine the inclusion, exclusion, and retirements of generation, transmission, and other resources, and also the sources and justification for its assumptions about the system outside its service area. Other parties presenting economic evaluations of the proposed transmission project should highlight any differences between resource and other input assumptions they utilize and those submitted by the applicant, and should address how the differences may affect the results of their analyses.

The Commission will examine the utilities' resource plans and their modeling of the system outside their service areas on an on-going basis as needed in CPCN and other relevant proceedings. We believe that it would be helpful to develop clear and consistent criteria regarding what resources should be included in or excluded from baseline resource plans, for use in CPCN and other Commission proceedings. Limited criteria have evolved in prior CPCN proceedings for when a pending generation facility should be included in the baseline resource plan, but the treatment of pending transmission upgrades has been addressed primarily on a case-by-case basis. Lacking a well-developed record on this matter, we hesitate to adopt specific criteria at this time. We plan to explore this matter further in the future.

Finally, we agree with the parties that the availability and cost of feasible alternatives should be evaluated as part of the economic evaluation of a proposed project, but that the exact approach should not be dictated at this time. Depending on the proposed project, alternatives to be examined may include other transmission projects or configurations, central station or distributed generation, renewable generation, demand-side options, and/or operating procedures or additional remedial action schemes. Each party submitting an economic evaluation in a transmission CPCN proceeding should identify alternatives it considered, the bases for its choices, and the results of its alternatives analysis.

## **VI. Comments on Proposed Decision**

The proposed decision of the ALJ in this matter was mailed to the parties in accordance with § 311(d) and Rule 77.1 of the Commission Rules of Practice and Procedure. The CAISO, DRA, and BAMx filed comments on the proposed

decision. SCE, SDG&E, and Global Energy filed reply comments taking issue with certain aspects of the CAISO and BAMx comments.

In its comments, DRA fully supports the proposed decision and recommends its adoption. DRA comments that adoption of the proposed decision should aid the goal of streamlining major transmission proceedings. It comments that, as an added benefit, the principles and minimum requirements for the economic evaluation of transmission projects in certification proceedings should “spill over” into other resource planning and procurement proceedings and that the statewide planning process should be well served with adoption of the proposed decision.

The CAISO takes issue with the proposed decision’s provision allowing a CPCN applicant to choose the type of system model to use in its economic assessment of the proposed transmission project. The CAISO reiterates its position that, because transportation models do not represent physical flows on the transmission system accurately, outcomes of transportation models are unreliable. We are unpersuaded by the CAISO’s arguments that benchmarking efforts can never be sufficient to allow reliance on economic evaluations based on the use of transportation models. However, we have clarified the discussion regarding the showing that a party in a CPCN proceeding must make regarding the adequacy of the system modeling efforts that underlie its economic evaluation of a proposed transmission project.

The CAISO requests, if the Commission intends to rely on D.03-02-069 as a justification for the continued acceptance of transportation models, that the Commission reopen the record to evaluate the accuracy of the modeling effort using a transportation model to assess the economic benefits of the Miguel-Mission and Imperial Valley upgrades. Our determination in today’s decision

that a CPCN applicant should not be required to use a specific type of system model results from our assessment of the parties' showings in this proceeding, and is not based on the earlier findings in D.03-02-069. There is no need to reopen the record regarding the economic evaluations of the Miguel-Mission and Imperial Valley upgrades undertaken in I.00-11-001.

BAMx reiterates its position, stated for the first time in its opening brief, that the Commission should develop the long-term cost of entry for new capacity for various regions within California. We see no reason to modify the proposed decision in this regard.

BAMx also urges the Commission to keep I.05-06-041 open to examine the application of the adopted principles in the context of intra-zonal projects, such as SDG&E's pending application for a CPCN for the Sunrise Powerlink transmission project (A.05-12-014). However, continuation of this investigation is not needed to ensure the proper application in CPCN proceedings of the principles and guidance adopted in today's decision. Consistent with the provisions of § 1701.5, this investigation should be closed at this time.

## **VII. Assignment of Proceeding**

Dian M. Grueneich is the Assigned Commissioner and Charlotte F. TerKeurst is the assigned ALJ in this proceeding.

## **Findings of Fact**

1. The CAISO's work in developing its TEAM approach has advanced the state of the art in economic evaluations of transmission projects.
2. The state of the art in economic evaluations of transmission projects continues to evolve, with continuing developments in system modeling capabilities and computer advances.



3. It is reasonable for the Commission to adopt general principles and provide guidance to establish a framework and minimum requirements for economic evaluations to be submitted in CPCN proceedings for proposed transmission projects.

4. The Commission should retain the ability to assess the adequacy of the applicant's showing regarding its baseline resource plan and alternatives to a proposed transmission project, and to maintain consistency among proceedings in which the Commission assesses alternative means of meeting California's energy needs.

5. It is reasonable to allow the Assigned Commissioner or assigned ALJ in a CPCN proceeding for a proposed transmission project to modify application of the minimum requirements for economic evaluations adopted in this decision with good cause shown, taking case-specific conditions into account.

6. It is reasonable for the Commission to assess the applicability of the principles and guidance adopted in this decision in the context of individual CPCN applications, as the need arises.

7. In economic evaluations of proposed transmission projects, there are three general categories of costs and benefits: (1) the change in total production costs, or energy benefits, (2) changes in other quantifiable economic costs and benefits not included in production cost analyses, and (3) factors whose economic effects cannot be monetized.

8. In evaluating a proposed transmission project, the distribution of potential benefits and costs among geographic areas and among various types of market participants can be assessed.

9. The WECC or Societal benefit-cost perspective takes into consideration all market participants in the WECC area, including consumers (or their load

serving entities), producers, and transmission owners or holders of transmission rights.

10. The Modified Societal benefit-cost perspective includes only the portion of producer profits derived from competitive prices, and excludes additional producer net revenue obtained through the exercise of market power.

11. The CAISO Ratepayer benefit-cost perspective includes the benefits and costs that would accrue to CAISO consumers, utility-retained generation, and transmission owners on the CAISO-controlled grid.

12. It is reasonable to use the CAISO's standardized benefit-cost methodology, as described in this decision, to measure the economic benefits of a proposed transmission project.

13. The perspective of CAISO ratepayers is of primary importance in the Commission's evaluation of a proposed transmission project, because it reflects the effects on customers of the utilities within our jurisdiction.

14. A transmission expansion may improve the import capability over a transmission path and allow access to additional sources of power, thus reducing producers' ability to exercise market power and lowering production costs, to the benefit of consumers.

15. For economic evaluations that include estimates of producers' strategic bidding behavior, the Modified Societal perspective is the appropriate perspective to use in evaluating societal benefits of the proposed transmission project.

16. Use of discount rates equal to the utilities' weighted cost of capital will facilitate consistent comparison of proposed transmission projects and alternative energy investments.

17. The energy benefits due to a proposed transmission project consist of the net changes in consumer costs, producer net income, and congestion revenues flowing to transmission owners or holders of transmission rights. The sum of these changes equals the change in energy production costs.

18. It is reasonable to use the CAISO's energy benefits framework for the computation of energy benefits of a proposed transmission project, as described in this decision.

19. Both network models and transportation models have advantages and disadvantages.

20. It is reasonable to allow the applicant to choose the type of system model to use in its showing of need for a proposed transmission project.

21. The modeling of the benefits of market power mitigation is a complex undertaking, and it is difficult to confirm the extent to which such forecasts produce reliable results.

22. It is reasonable to allow the applicant to determine whether to include information regarding market power mitigation benefits as part of its showing of need for a proposed transmission project.

23. It is reasonable to require that parties identify significant assumptions and simplifications in their modeling of the economic impacts of proposed transmission projects, the reasons for those choices, and possible effects on study results.

24. It is reasonable to require that, in economic evaluations of proposed transmission projects, system operations be modeled for at least two years, with the years chosen several years apart.

25. It is reasonable to require that, in its economic evaluation of a proposed transmission project, each party address the extent to which resource or time

constraints affected its economic study design choices and the basis for any resulting trade-offs it made among study attributes.

26. Evaluations of proposed transmission projects require judgments and assumptions about system and market assumptions for many years into the future and even the best forecasts are inherently uncertain in this regard.

27. It is reasonable to require that an applicant address how uncertainty about future system and market conditions affects the likelihood that the proposed transmission project's forecasted economic benefits will be realized, taking into account a reasonable range of possible variations in key study parameters and contingency events.

28. It is reasonable to require that an applicant proposing a transmission project expected to cost more than \$100 million provide a probabilistic analysis of the effects of uncertainty on the expected benefits of the project.

29. It is reasonable to require that each party submitting an economic evaluation in a transmission CPCN proceeding provide at least one cost-based deterministic reference case, with the applicant using its baseline resource plan and other parties mirroring the resources and other key assumptions in the applicant's reference case to the extent feasible.

30. It is reasonable to require that a party that models the effects on strategic bidding of a proposed transmission project submit a market-based reference case that varies from its cost-based reference case only in its forecast of strategic bidding.

31. It is reasonable to require that each party identify the parameters, assumptions, or relationships that most affect the conclusions in its economic evaluation of a proposed transmission project.

32. It is reasonable to require that the applicant identify any attributes of its proposed transmission project that may increase societal costs or have other detrimental effects and, if possible, quantify the potential effects.

33. It is reasonable to require that each party specify the level of project costs it assumed in its economic evaluation of a proposed transmission project, and how a change in project costs would affect its cost-effectiveness results.

34. The importance of identifying and quantifying non-energy economic benefits of a proposed transmission project depends, to some extent, on whether identified energy benefits provide sufficient justification for the project.

35. It is reasonable to require that, in its economic evaluation of a proposed transmission project, the applicant use a baseline resource plan and assumptions about the system outside the applicant's service territory that are consistent with its resource plan and system assumptions used in procurement or other recent Commission proceedings, with identification and explanation of any differences.

36. It is reasonable to require that, in their economic evaluations of a proposed transmission project, parties other than the applicant identify and justify any differences between the resource plan and other input assumptions they utilize and those submitted by the applicant.

37. It is reasonable to evaluate the availability and cost of feasible alternatives as part of the economic evaluation of a proposed transmission project.

38. It is reasonable to require that each party identify alternatives to the proposed transmission project that it considered, the bases for its choices, and the results of its alternatives analysis.

39. It is reasonable to adopt the Principles and Minimum Requirements for the Economic Evaluation of Transmission Projects appended as Attachment A, with the further guidance provided in this decision, for use in CPCN proceedings in

which the applicant proposes a transmission project wholly or partly on the basis of expected economic benefits.

### **Conclusions of Law**

1. The Principles and Minimum Requirements for the Economic Evaluation of Transmission Projects appended as Appendix A should be adopted, with the further guidance provided in this decision, for use in CPCN proceedings in which the applicant proposes a transmission project wholly or partly on the basis of expected economic benefits.

2. The Assigned Commissioner or assigned ALJ in a CPCN proceeding should be allowed to modify application of the minimum requirements for economic evaluations adopted in this decision with good cause shown, taking case-specific conditions into account.

3. This order should be effective today so that the adopted principles and guidance can be applied to transmission projects that the Respondents may propose.

4. This proceeding should be closed.

**ORDER****IT IS ORDERED** that:

1. We adopt the Principles and Minimum Requirements for the Economic Evaluation of Transmission Projects (Principles and Minimum Requirements) appended as Attachment A, with the further guidance provided in this decision, for use in certificate of public convenience and necessity (CPCN) proceedings in which the applicant proposes a transmission project wholly or partly on the basis of expected economic benefits.
2. Pacific Gas and Electric Company, Southern California Edison Company, and San Diego Gas & Electric Company shall each submit an economic evaluation consistent with the Principles and Minimum Requirements and the further guidance provided in this decision, as part of its showing in any proceeding in which it requests a CPCN for a transmission project proposed wholly or partly on the basis of expected economic benefits.
3. Non-applicant parties in CPCN proceedings considering a transmission project proposed wholly or partly on the basis of expected economic benefits may submit economic evaluations that are consistent with the Principles and Minimum Requirements and the further guidance provided in this decision.
4. The Assigned Commissioner or assigned Administrative Law Judge in a CPCN proceeding considering a transmission project proposed wholly or partly on the basis of expected economic benefits may modify application of the

minimum requirements for economic evaluations adopted in this order with good cause shown, taking case-specific conditions into account.

5. Investigation 05-06-041 is closed.

This order is effective today.

Dated \_\_\_\_\_, at San Francisco, California.



**ATTACHMENT A**  
**Page 1**

**PRINCIPLES AND REQUIREMENTS FOR THE ECONOMIC  
EVALUATION OF TRANSMISSION PROJECTS IN CPCN PROCEEDINGS**

**PRINCIPLES:**

**1. Benefits Framework**

The CAISO's standardized benefit-cost methodology, as described in this decision, shall be used to measure the economic benefits of proposed transmission projects. The perspective of CAISO ratepayers is of primary importance in a CPCN proceeding because it reflects the effects on customers of the utilities within the Commission's jurisdiction.

The discount rate to be used in evaluating the benefits of a proposed transmission project shall be the applicant's weighted cost of capital adopted most recently by the Commission.

Economic assessments of proposed transmission projects shall consider three categories of costs and benefits: (a) the change in total production costs, or energy benefits; (b) changes in other quantifiable economic costs and benefits not included in the production cost analysis; and (c) factors whose effects cannot be monetized.

**2. Energy Benefits**

The CAISO's framework, as described in this decision, for the computation of potential energy benefits of a proposed transmission project shall be used. The change in production costs, or the energy benefits, has three components: the change in consumer costs, the change in producers' profits, and the change in congestion revenues flowing to transmission owners or holders of transmission rights.

Parties shall assess energy benefits using an established, credible, and commercially-available production cost modeling tool. Computer modeling access requirements of Public Utilities Code Sections 1821 and 1822 shall be met consistent with Rules 74 and 87 of the Commission Rules of Practice and Procedure.

**ATTACHMENT A****Page 2****PRINCIPLES AND REQUIREMENTS FOR THE ECONOMIC  
EVALUATION OF TRANSMISSION PROJECTS IN CPCN PROCEEDINGS**

The applicant may decide whether to include market power mitigation benefits as part of its demonstration of need for a proposed transmission project.

Parties shall model system operations for at least two years, with the years chosen several years apart. The Commission prefers that parties also model system operations during the intervening years, particularly if there are significant system changes, e.g., large transmission or generation additions or retirements, during those years.

3. Other Economic Benefits and Costs

In addition to energy benefits, other economic effects of a proposed transmission project may be considered, including economic effects that may not be quantifiable. The applicant shall identify in its economic evaluation any attributes of the proposed transmission project that may increase societal costs in some manner.

4. Uncertainty Analysis

Economic evaluations shall consider how uncertainty about future system and market conditions affects the likelihood that a proposed transmission project's forecasted benefits will be realized.

5. Resource Plans and Other Input Assumptions

Economic evaluations of proposed transmission projects shall use baseline resource plans and assumptions about the system outside the applicant's service territory that are consistent with resource plans and system assumptions used in procurement or other recent Commission proceedings, updated as appropriate. Potential changes to the system that may result from or accompany construction of the proposed project shall be taken into account.

## ATTACHMENT A

## Page 3

**PRINCIPLES AND REQUIREMENTS FOR THE ECONOMIC  
EVALUATION OF TRANSMISSION PROJECTS IN CPCN PROCEEDINGS**6. Alternative Resource Options

Economic evaluations shall consider feasible resource alternatives to the proposed transmission project. Depending on the transmission project, these alternatives may include, but are not limited to, other transmission projects or configurations, central station or distributed generation, demand-side options, operating procedures, and/or additional remedial action schemes.

## REQUIREMENTS:

1. Benefits Framework

Each party that submits an economic evaluation in a transmission CPCN proceeding shall report benefits from, at a minimum, the CAISO Ratepayer perspective and the Societal perspective.

If a party quantifies and attributes benefits based on mitigation of market power, the party shall report benefit-cost results using both the Societal and Modified Societal perspectives.

2. Energy Benefits

Parties shall report separately the three components of their energy benefit calculations, that is, the changes in consumer surplus, producer surplus, and transmission surplus (congestion revenues). This level of detail shall be provided for each benefit perspective reported, i.e., the Societal, Modified Societal, CAISO Ratepayer, and any other benefit perspectives reported.

If a party attributes benefits based on mitigation of market power, the party shall include a complete description of its bidding strategy methodology and steps taken to validate its predictive ability in anticipated market conditions. The party shall also submit a comparable economic analysis that does not include strategic bidding or market power mitigation benefits.

**ATTACHMENT A****Page 4****PRINCIPLES AND REQUIREMENTS FOR THE ECONOMIC  
EVALUATION OF TRANSMISSION PROJECTS IN CPCN PROCEEDINGS**

Each party shall identify and justify significant assumptions and simplifications in its economic analysis, and shall provide information about the likely effects of the assumptions and simplifications. In particular, each party shall address its treatment of the following modeling issues:

- Modeling of power flows, constraints and congestion charges within both the CAISO control area and all other areas included in system simulations.
- Modeling of generation unit commitment and dispatch.
- Modeling of bilateral contracts and assumptions about future contracts.
- Assumptions about ownership of new generation facilities.
- Number and choice of years studied, the method for estimating benefits for years not studied, and the number of hours per year for which system operations are simulated. The party shall provide a sensitivity analysis addressing the effect on benefit-cost results of different assumptions about energy benefits in years that are not simulated.

**3. Other Benefits and Costs**

The applicant shall identify any attributes of its proposed transmission project that may increase societal costs or have other detrimental effects and, if possible, quantify the potential effects. In addition to energy benefits, parties are encouraged to identify other beneficial economic aspects of the transmission project. Parties may include these factors in their uncertainty analyses, to the extent appropriate.

If a party quantifies changes in non-energy economic benefits or costs, the party shall identify separately the economic value of each of those benefits or costs.

Each party shall specify the level of project costs (including capital and operation and maintenance costs) it assumed in its economic evaluation, and shall specify,

**ATTACHMENT A****Page 5****PRINCIPLES AND REQUIREMENTS FOR THE ECONOMIC  
EVALUATION OF TRANSMISSION PROJECTS IN CPCN PROCEEDINGS**

through a formula if appropriate, how a change in project costs would change any benefit-cost ratios or other numerical benefit-cost results in its economic evaluation.

**4. Uncertainty Analysis**

The applicant shall submit an uncertainty analysis that considers a reasonable range of possible variations in key study parameters and contingency events. For any proposed transmission project expected to cost more than \$100 million, the applicant's uncertainty analysis shall include a probabilistic evaluation.

Each party that submits an economic evaluation shall provide the inputs and corresponding results for each deterministic case, individual probability case (whether stochastically or manually derived), and each contingency event whose possible economic consequences are quantified.

Each party that submits an economic evaluation shall provide a cost-based (that is, without strategic bidding) deterministic reference case. The applicant shall use its baseline resource plan and assumptions about the system outside its service territory from procurement or other recent Commission proceedings, modified as appropriate. Other parties shall mirror resource and other key assumptions in the applicant's reference case to the extent feasible. Any party that models strategic bidding shall submit a market-based reference case that varies from its cost-based reference case only in its forecast of strategic bidding.

Each party shall identify the parameters in its economic analysis whose realized values are most likely to affect the cost-effectiveness of the transmission project under consideration.

**5. Resource Plans and Other Input Assumptions**

The applicant shall use a baseline resource plan and assumptions about the system outside its service territory that are consistent with its resource plan and system assumptions used in procurement or other recent Commission proceedings, with identification and explanation of any differences. The

**ATTACHMENT A****Page 6****PRINCIPLES AND REQUIREMENTS FOR THE ECONOMIC  
EVALUATION OF TRANSMISSION PROJECTS IN CPCN PROCEEDINGS**

applicant shall consider any potential changes to the system that may result from or accompany construction of the proposed project.

The applicant shall specify the criteria it used to determine the inclusion, exclusion, and retirements of generation, transmission, and other resources in its baseline resource plan, and also the source and justification for its assumptions about the system outside its service area.

Other parties shall identify and justify any differences between the resource plans and other input assumptions they utilize and those submitted by the applicant, and shall address how the differences may affect the results of their analysis.

6. Alternative Resource Options

Each party shall identify the resource alternatives to a proposed transmission plan that it considered, the bases for its choices, and the results of its alternatives analysis.

7. General

If the CAISO has determined that a proposed transmission project is needed, the applicant shall present the CAISO's economic evaluation and may use the CAISO assessment to help meet its burden of proof.

Each party shall address the extent to which resource or time constraints affected its study design choices, including but not limited to the type of model used, the number of years and the number of hours per year studied, and the number of scenarios or stochastic iterations performed. Each party shall address the basis for any resulting trade-offs it made among such study attributes.

**(END OF ATTACHMENT A)**

ATTACHMENT B

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